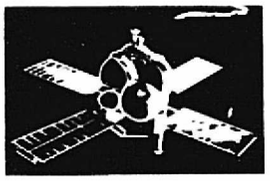
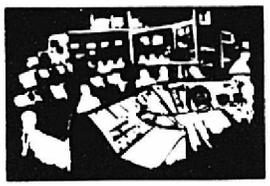
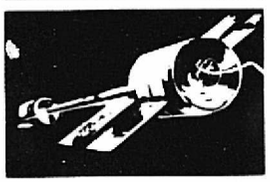
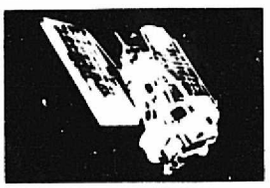
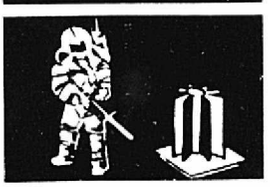
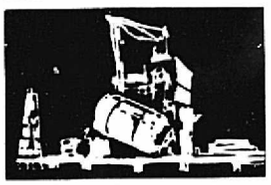
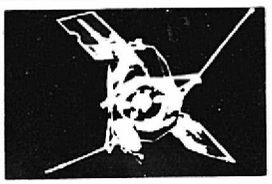
SPACE DIVISION





DOCUMENTATION BRANCH
CODE 256

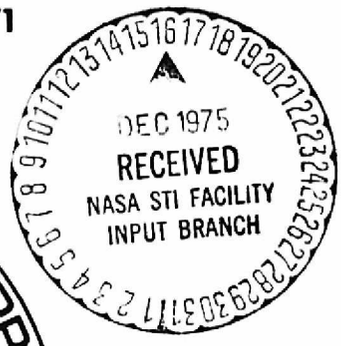
75SDS4228
15 AUGUST 1975

LANDSAT-1 AND LANDSAT-2 EVALUATION REPORT 23 JANUARY 1975 TO 23 APRIL 1975

Prepared By
GE LANDSAT OPERATIONS CONTROL CENTER

For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771



Contract NAS5-21808

GENERAL ELECTRIC

GENERAL ELECTRIC

O/L 104
SPACE DIVISION

SPACE SYSTEMS
ORGANIZATION

GENERAL ELECTRIC COMPANY . . .
(MAIL: 5030 HERZEL PLACE, BELTSVILLE, MARYLAND 20705), Phone (301) 345-6000

October 20, 1975

TO: Distribution

FROM: D. Wise

ERRATA

Errata for Document 75SDS4228, Landsat-1 and Landsat-2 Evaluation Report, 23 January 1975 to 23 April 1975, dated 15 August 1975.

Landsat-1

Page 4-1, fifth paragraph, delete "currents". Text should read, "Solar Array Drive Voltages, Temperatures, and...".

Page 4-5, Table 4-2, Function 1092, title should read "RMP2 MTR Current".

Page 15-1, Figure 15-1 vertical scale should read "Number of Head-to-Tape Contacts ($X10^3$)."

Landsat-2

Page 4-1, fourth paragraph, second sentence, delete "currents". Text should read "All motor voltages and temperatures were normal".

Page 11-1, third paragraph, first sentence, should read "...on Landsat-2 has ranged between 30-35°C during...".

Page 16-1, fourth paragraph, first sentence, should read "In Appendix D a scene...". Fourth paragraph, last sentence should read "Band 1 (Figure D-1) is...".

Page C-10, Table 2, Figure 2, obliterated function numbers are 13032 and 13033.

Dist:
One per 75SDS4228 Report

DGW/kfm

Daniel G. Wise

Daniel G. Wise, Supervisor
Off-Line Engineering

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

This is the tenth report in a continuing series of documents issued quarterly to present flight performance analysis of the LANDSAT-1 Spacecraft. Previously issued documents are:

72SD4255	ERTS-1 Launch and Flight Activation Evaluation Report 23 to 26 July 1972	18 October 1972
72SD4262	ERTS-1 Flight Evaluation Report 23 July 1972 to 23 October 1972	28 November 1972
72SD4224	ERTS-1 Flight Evaluation Report 23 October 1972 to 23 January 1973	27 February 1973
73SD4249	ERTS-1 Flight Evaluation Report 23 January 1973 to 23 April 1973	29 May 1973
73SD4260	ERTS-1 Flight Evaluation Report 23 April 1973 to 23 July 1973	10 August 1973
73SD4274	ERTS-1 Flight Evaluation Report 23 July 1973 to October 1973	28 November 1973
74SD4205	ERTS-1 Flight Evaluation Report 23 October 1973 to 23 January 1974	26 February 1974
74SD4217	ERTS-1 Flight Evaluation Report 23 January 1974 to 23 April 1974	18 May 1974
74SD4236	ERTS-1 Flight Evaluation Report 23 April 1974 to 23 July 1974	15 August 1974
74SD4255	ERTS-1 Flight Evaluation Report 23 July 1974 to 23 October 1974	31 December 1974
75SD4222	LANDSAT-1 Flight Evaluation Report 23 October 1975 to 23 January 1975	30 April 1975

This report contains analyses of performance for orbits 12476 to 14000 for LANDSAT-1.

SECTION 1

SUMMARY
LANDSAT-1 OPERATIONS

The LANDSAT-1 spacecraft was launched from the Western Test Range on 23 July 1972 at 18:08:06.508Z. The launch and orbital injection phase of the space flight were nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147 after which an internal short circuit disabled one of the Wideband Video Tape Recorders (WBVTR-2). Operations resumed until Orbit 196 when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands and since that time LANDSAT-1 has performed its mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. The remaining Wideband Video Tape Recorder experienced four suspensions of operation, the last being in Orbit 9881 on 2 July 1974, and has not been used operationally since. In Orbit 4396 an integrated circuit chip in the TMP failed, disabling four TLM functions. COMSTOR "B" has an intermittent problem with cell 12, which is not being used operationally. The "B" section of the USB with full power output of 1.5 watts was substituted for the "A" section in Orbit 10068 because of excessive decline of transmitter power. The pitch flywheel stopped for 2 minutes in Orbit 8040; and for 8 hours, 2 minutes in Orbits 11125 to 11130. It has been kept close to zero speed ever since, using pitch-bias control. The RMP was switched from B to A in Orbit 11257 as a precautionary measure after RMP B began showing operating current variations. The DCS subsystem was turned off after Orbit 12690 and the function assumed by LANDSAT-2. Spacecraft performance has not been degraded by these anomalies thus far, except for the inability to record remote MSS imagery.

ORBITAL PARAMETERS

The initial orbit of LANDSAT-1 required some correction at Orbits 38, 44, and 59 to achieve the desired 18-day repeat cycle. During Orbits 938, 2416, 6390 and 7826 it was necessary to fire the -X thruster of the orbit adjust system to maintain the ground trace in the desired 18-day repeat pattern of $\pm$ 10 nm. On September 29, 1974, the ACS control system fired gas during the spacecraft emergency (pitch flywheel stoppage) which resulted in an unplanned orbit change similar to firing the -X thrusters. During orbits 11367, 11464 and 13611 the +X thruster was fired to maintain the ground trace in the desired 18-day repeat pattern of $\pm$ 10 nm.

POWER SUBSYSTEM (PWR)

The power subsystem performed well throughout this report period. Solar array current has been slightly lower than predicted. Data from this period shows the array degradation to be -26.1% after 33 months in orbit. The power subsystem will meet LANDSAT-1 power requirements through 1976 with the present payload configuration.

ATTITUDE CONTROL SUBSYSTEM (ACS)

From initial acquisition, the ACS performance has been excellent except between Orbits 11125 and 11130 when the Pitch flywheel stopped and restarted approximately 8 hours later. Pitch flywheel speed, after Orbit 11130, was maintained between -20 RPM and -100 RPM by use of Pitch Position Bias which eliminated pitch gating. Similarly, roll momentum unloading was accomplished by employing Roll Diff Tach Hi Gain during orbits of non-MSS activity to reduce Roll gating. During a portion of Orbit 13922, the Single Scanner mode was exercised successfully in a test designed to eliminate normal night to day sun transients effecting MSS sun calibration. All functions are active and within specifications at the end of this report period. RMP A is operating normally and the SADS are tracking accurately. The forward IR scanner pressure has decreased slightly from 3.33 PSIA (Orbit 12749) to 3.08 PSIA (Orbit 13970).

COMMAND/CLOCK SUBSYSTEM (CMD)

All stored commands and real time commands were executed except for the expected one-in-approximately 10,000 associated with the logic race conditions. No serious problems have resulted from these few commands failing to execute. Use of cell 12 COMSTOR "B" has been discontinued for active commands because of intermittent time delta errors of 256 seconds. Occasionally, stored commands are blocked by real-time sequences which overlap in time. The specific cause has not been determined. The VHF command receiver was switched from side B to side A at the time of USB subsystem switchover to side B. The PCM regulators occasionally switched, without commands, from Unit 1 to 2 and then back from 2 to 1, and was attributed to VHF input signal transients in the command channel.

TELEMETRY SUBSYSTEM (TLM)

The telemetry subsystem has consistently performed in an excellent manner. Memory Section 0, 0 in use since launch was changed to the 1, 1 mode in Orbit 12565 on 10 January 1975. All dropouts have been associated with known link or ground problems. Except for the failure of an integrated circuit chip in the TMP (Orbit 4396), which disabled four telemetry functions, all functions have performed in a nominal manner. The VHF transmitter is fully effective, and shows little power loss since launch.

ORBIT ADJUST SUBSYSTEM (OAS)

The orbit adjust system has been fired ten times; seven times using the -X thruster, and three times using the +X thruster. Three -X firings were for initial orbit corrections and four -X for orbit maintenance. The three +X firings were used for orbit maintenance. Pressure/temperature parameters continue to be normal.

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The Magnetic Moment Compensating Assembly was not operated during this report period. There have been a total of eleven operations since launch. The MMCA has held the Pole-Cm commanded in prior orbits. Telemetry values continue to be normal.

UNIFIED "S" BAND/PRE-MODULATION PROCESSOR (USB)

The Unified S-Band Subsystem has operated satisfactorily since launch. In Orbit 10068 the B-Section was substituted for the A-Section because the A-transmitter power output had declined from 1.5 watts at launch to 0.14 watts with noticeable loss of DCS coverage. The B-transmitter with a power output of 1.5 watts has operated without power drop since turn ON, restoring full DCS coverage until DCS turn off in Orbit 12690.

ELECTRICAL INTERFACE SUBSYSTEM (EIS)

The Auxiliary Processing Unit (APU), Interface Switching Module (ISM) and Power Switching Module (PSM) performed normally during this report period. The RBV switching relay (within the PSM) failed in Orbit 196.

THERMAL CONTROL SUBSYSTEM (THM)

The thermal subsystem performed normally throughout this period. Temperatures decreased slightly due to decreasing sun intentsity.

NARROWBAND TAPE RECORDER SUBSYSTEM (NBR)

Narrowband Tape Recorder A (NBR-A) has continued to operate satisfactorily without incident. NBR-B became noisy and was temporarily turned OFF in Orbit 13015. NBR-A is handling the entire telemetry Record and Playback functions on a restricted schedule to conserve its life. Total ON Time is 12173 hours for Recorder A and 11851 hours for Recorder B.

WIDEBAND TELEMETRY SUBSYSTEM (WBTS)

The Wideband Telemetry Subsystem has continued to operate satisfactorily. The power output has continued at 20 watts since switching to that mode in Orbit 30. WPA-2 is currently in use. WPA-1 was used with RBV to Orbit 196 and subsequently with MSS between Orbits 1890 and 2099 during Apollo 17 operations.

ATTITUDE MEASUREMENT SENSOR (AMS)

The AMS continues to function normally in all aspects.

WIDEBAND VIDEO TAPE RECORDERS (WBVTR)

WBVTR-2 failed after 10 days in orbit. WBVTR-1 had 4 major disruptions in service since launch and was removed from service after Orbit 9881.

RETURN BEAM VIDICON (RBV)

The Return Beam Vidicon has been idle since Orbit 196 when its prime input power switching relay failed. RBV performed satisfactorily up to that point and is available for use, if needed, by an alternate switching mode.

MULTISPECTRAL SCANNER SUBSYSTEM (MSS)

The Multispectral Scanner Subsystem continues to operate in a completely satisfactory manner. It has imaged nearly all of the land masses between the latitudes of 81.42°. All units of the Subsystem are normal and stable. It now operates in real time only and provides data to Brazil, Canada, and Italy as well as in the USA.

DATA COLLECTION SYSTEM (DCS)

The Data Collection Subsystem operated satisfactorily thru Orbit 12690. Only Receiver A has been used. After Orbit 12690 the DCS subsystem was turned off and the DCS in LANDSAT-2 assumed this function.

IN-ORBIT PAYLOAD SYSTEM PERFORMANCE
LAUNCH THRU ORBIT 13980
LANDSAT-1

RBV	Total Scenes Imaged	1690
	AVG. Scenes/Day	139
	Total Area Imaged (millions of sq. mi.)	14.7
	ON TIME (hr.)	14.0
	ON/OFF Cycles	91
	% Real Time Images	57
	% Recorded Images	43
MSS	Total Scenes Imaged	165,707
	AVG. Scenes/Day	172
	Total Area Imaged (millions of sq. n. mi.)	1,444.9
	ON TIME (hr.)	1,748.67
	ON/OFF Cycles	13,237
	% Real Time Images	72
	% Recorded Images	28
DCS	Messages at OCC	1,152,045
	Non-Perfect MSGS	90,691
	Max. DCP's ACTIVE/DAY	114
	Users	44
	Avg. MSG/Orbit	181
	ON TIME (hr.)	21,820.2
WPA-1	% Real Time Mode	55
	% Playback Mode	45
	ON TIME (hr.)	31.9
	ON/OFF Cycles	311
WPA-2	% Real Time Mode	72
	% P/B Mode	28
	ON TIME (hr.)	1,695.3
	ON/OFF Cycles	10,843
WBVTR-1	% Record Mode	38
	% Playback Mode	41
	% Rewind Mode	20
	% Standby Mode	1
	Minor Frame Sync Error Count in P/B	150
	Time Head-Tape Contact (hr.)	732.8
	Cycles Head-Tape Contact	11,954
	ON TIME (hr.)	927.6
WBVTR-2	% Record Mode	38
	% Playback Mode	41
	% Rewind Mode	20
	% Standby Mode	1
	MFSE Count in P/B	Failed Orb. 148
	Time Head-Tape Contact (hr.)	5.1
	Cycles Head-Tape Contact	44
	ON TIME (hr.)	6.5

SECTION 2

ORBITAL PARAMETERS
LANDSAT-1

LANDSAT-1 launch and injection was satisfactory and required only a minor orbit adjust to achieve normal parameters. These adjustments were made in Orbits 38, 44 and 59. After several 18-day repeat cycles, orbit maintenance burns were made in Orbit 938, 2416, and 6390, 7826, 11367, 11464 and 13611. An unplanned orbit change occurred due to freon gas expended during the pitch flywheel emergency (Orbits 11125 to 11130).

The orbital parameters are given in Table 2-1. Figure 2-1 shows the sub-satellite plot and Figure 2-2 shows the longitude error as a function of time and orbit maintenance burns. The longitude error has been maintained within the $\pm$ 10 nm average in the east-west direction at the equator as planned. Figure 2-3 shows the change of sun time at the descending node equator crossing. Appendix C gives ground trace repeat cycle predictions.

Table 2-1. LANDSAT-1 Brouwer Mean Orbital Parameters

Element Date	Apogee (KM)	Perigee (KM)	Inclination (Deg.)	Semi Major Axis (KM)	Eccentricity	Two Body Period (Min.)	Nodal Period (Min.)	Argument of Pergiee (Deg.)	Right Ascension (Deg.)	Mean Anomaly (Deg.)
25 Oct 1972	917.3	898.1	99.103	7285.850	0.00132	103.152	103.268	93.721	1.060	86.484
25 Jan 1973	922.3	893.1	99.090	7285.865	0.00200	103.153	103.268	133.693	91.805	52.797
25 Apr 1973	911.056	888.763	99.073	7285.767	0.00073	103.151	103.267	168.857	181.411	11.098
25 Jul 1973	914.341	900.810	99.068	7285.741	0.00093	103.150	103.266	95.602	268.944	84.301
25 Oct 1973	922.013	893.229	99.056	7285.786	0.00198	103.151	103.266	65.071	0.291	301.002
25 Jan 1974	915.873	899.111	99.041	7285.657	0.00115	103.148	103.264	160.866	88.606	19.049
24 Apr 1974	920.090	912.672	99.023	7285.691	0.000802	103.149	103.265	117.631	176.743	62.319
23 Jul 1974	922.363	892.629	99.017	7285.661	0.002041	103.148	103.264	109.225	269.779	70.540
23 Oct 1974	918.657	896.316	99.004	7285.652	0.00153	103.148	103.264	150.750	354.743	29.110
24 Jan 1975	914.18	900.67	98.990	7285.590	0.000928	103.147	103.262	278.848	85.403	261.138
24 Apr 1975	914.74	900.05	98.972	7285.559	0.001008	103.146	103.262	37.047	173.043	142.764

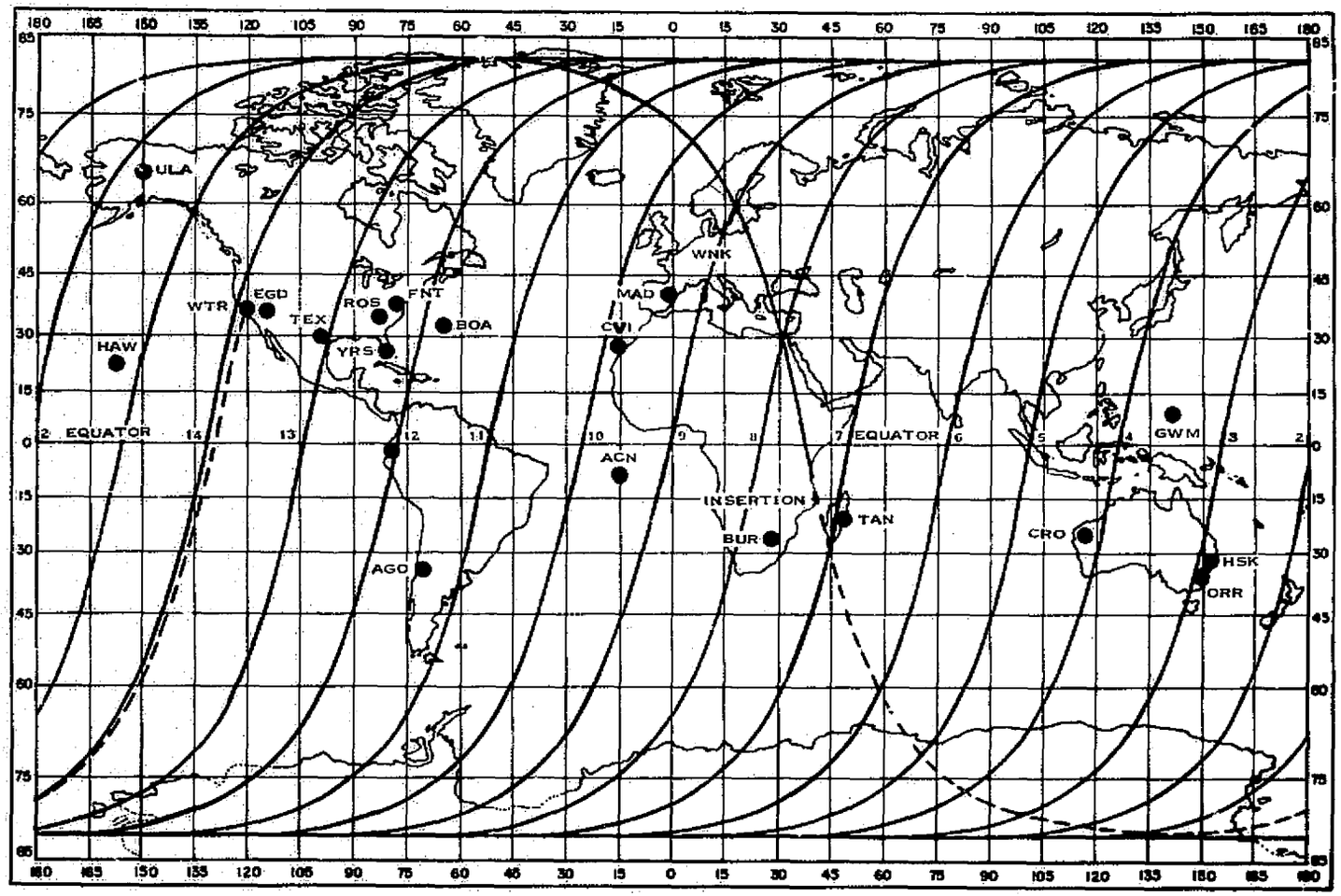
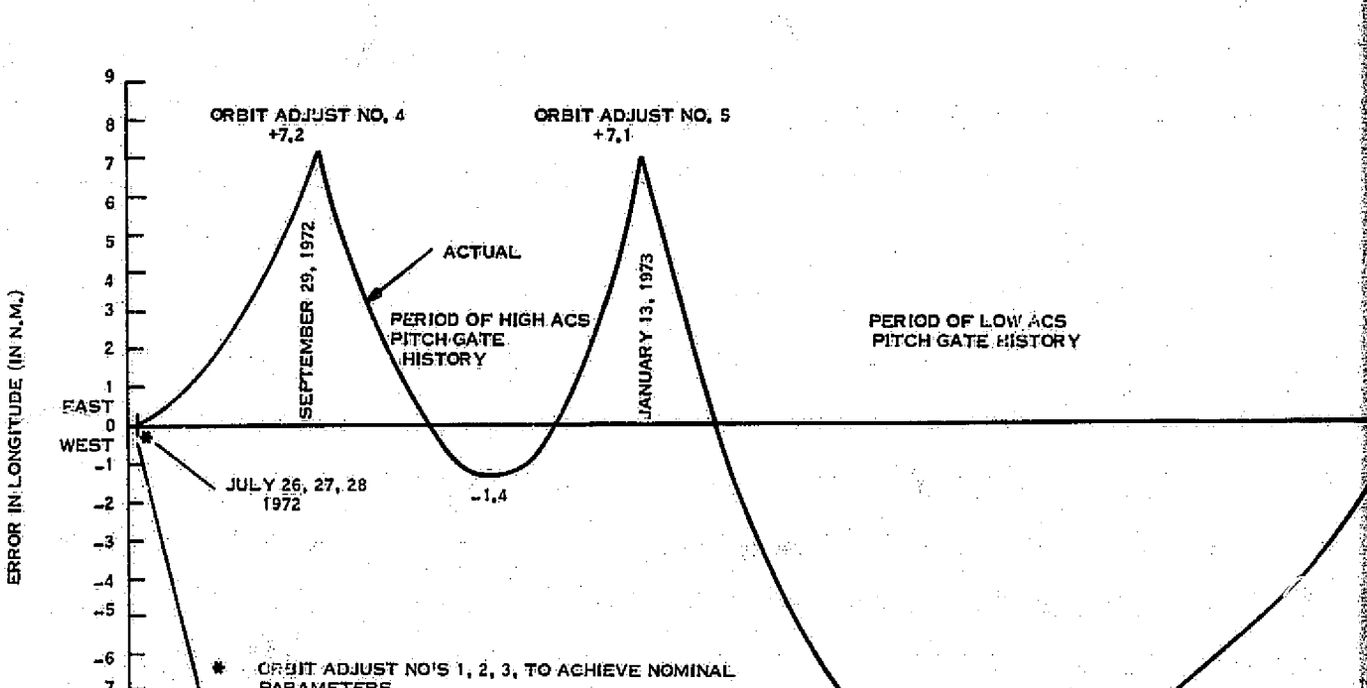


Figure 2-1. Typical Subsatellite Plot of the LANDSAT-1 Spacecraft



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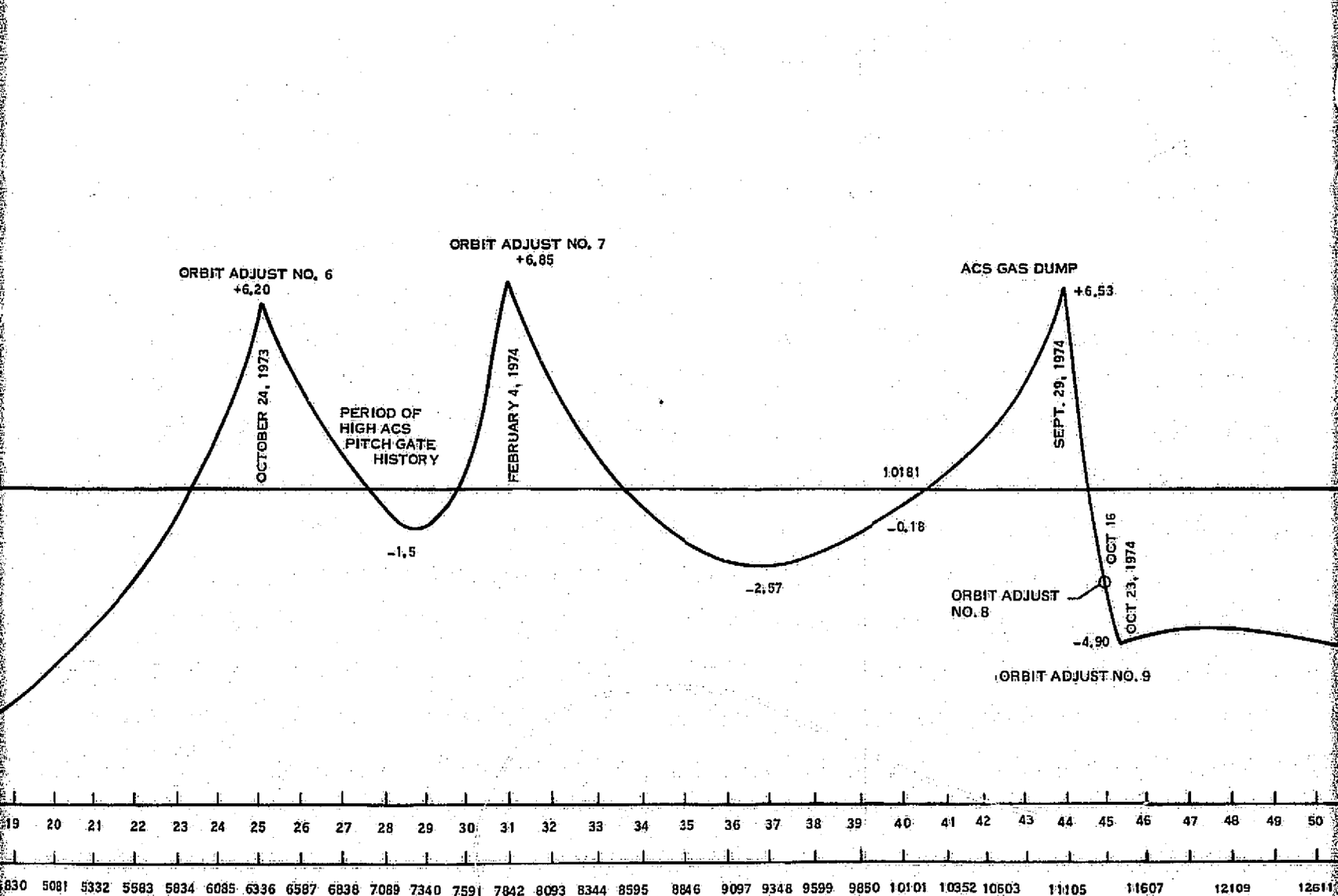

Figure 2-2. Effects
Ground Track

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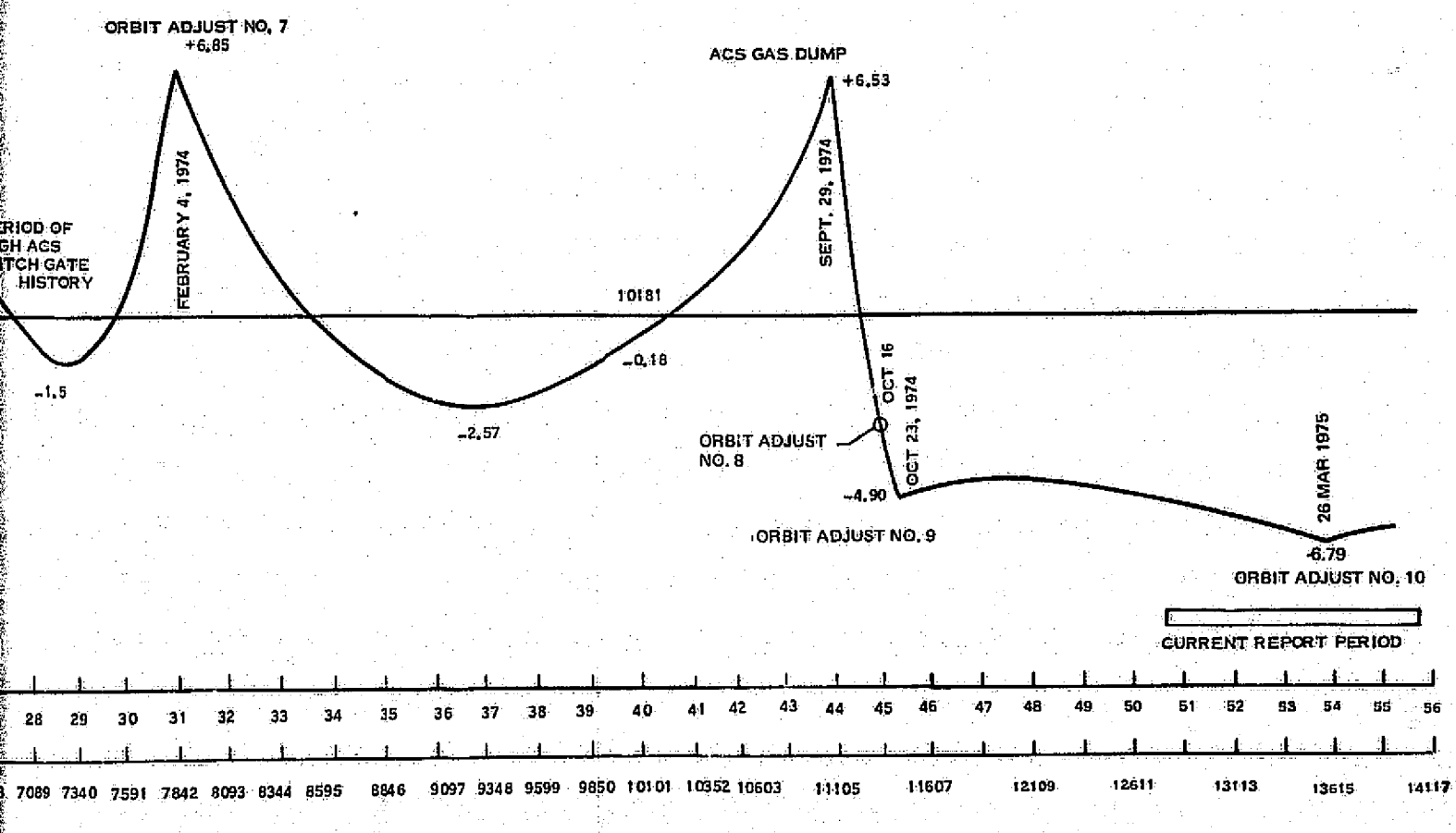


Figure 2-2. Effects of Orbit Adjust on Ground Track (LANDSAT-1)

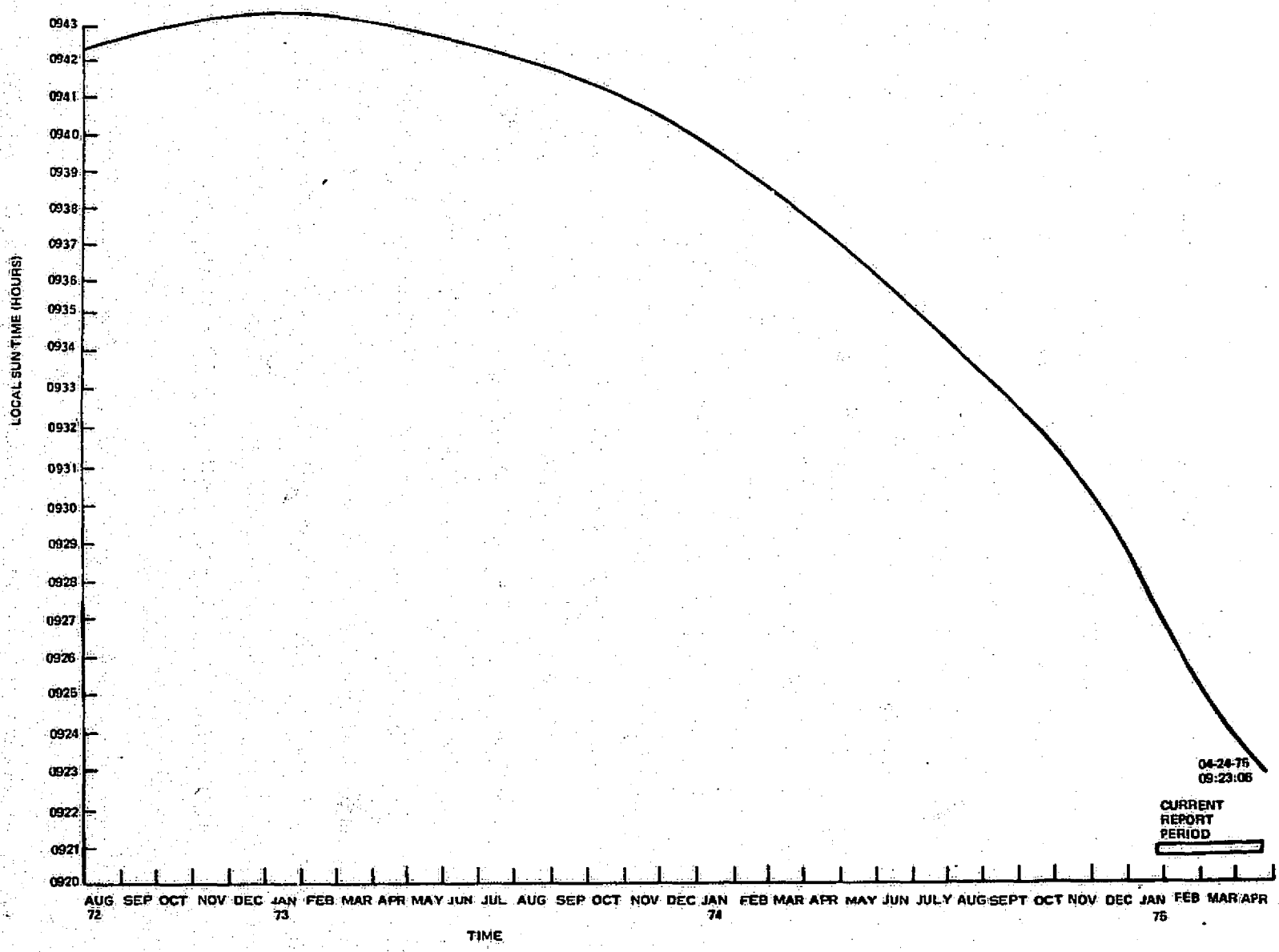


Figure 2-3. LANDSAT-1 Local Sun Time Equator Crossing-Descending Node

SECTION 3

POWER SUBSYSTEM (PWR)
LANDSAT-1

The solar array continued to provide excess energy for the payload and spacecraft load throughout this report period. Compensation loads and auxiliary loads dissipated the excess power above the battery and load requirements using LANDSAT-1 power management procedures. Midday measured solar array current tracked slightly below the values predicted earlier due to higher than predicted beta angle variations. Solar array degradation was -26.1% at the end of 33 months in orbit. The power subsystem is predicted to have adequate power through 1976 for the present LANDSAT-1 payload configuration, and may extend to 1977 and 1978 depending on the electro-chemical degradation of the battery packs for that period.

A plot of measured and predicted midday solar current is shown in Figure 3-1. Figure 3-2 shows actual and predicted solar array current degradation. Figure 3-3 shows actual sun angles to the spacecraft and solar panels. Figure 3-4 is a comparison of predicted beta angles (sun angle to orbit plane) for LANDSAT -1 and LANDSAT-2 in 1975. Figure 3-5 shows seasonal solar intensity variation. It is noted on Figure 3-1 that the high noon solar array current is slightly lower than predicted. This is due to slightly different solar panel sun angles and operating point high noon solar array degradation than initially predicted.

Battery packs averaged a typical 8.5 to 9% Depth of Discharge (DOD) during this report period. Charge and load sharing were satisfactory except for Battery 6. The load sharing of Battery 6 continued to drop, reaching about 7.7% around Orbit 13300. At the time, the battery had a charge/discharge ratio of 2.66 and its temperature had climbed to 31°C. Therefore, the battery was turned off in Orbit 13346 for a restoration cycle, expecting a recombination of gases within the individual cells. The battery is discharged through a telemetry load and is scheduled to be turned on when its voltage reaches approximately 26.5v. Due to the Battery 6 anomaly, the temperature spread between batteries reached as high as 12°C during this report period; but, since turn off and due to decreasing sun intensity, has dropped, reaching about 6°C at the end of this report period.

The power system electronics performed well in this report period with all voltages stable. Table 3-1 shows major power subsystem parameters and Table 3-2 shows power subsystem telemetry for selected orbits. Some parameters in Table 3-2 may be slightly different from Table 3-1, because Table 3-1 uses a power management time span (night followed by a day); whereas, the time span used in Table 3-2 is the playback period from the NBR. The Shunt Limiter has not operated since Orbit 3 because the unregulated voltage has been held below cut-in voltage by power management.

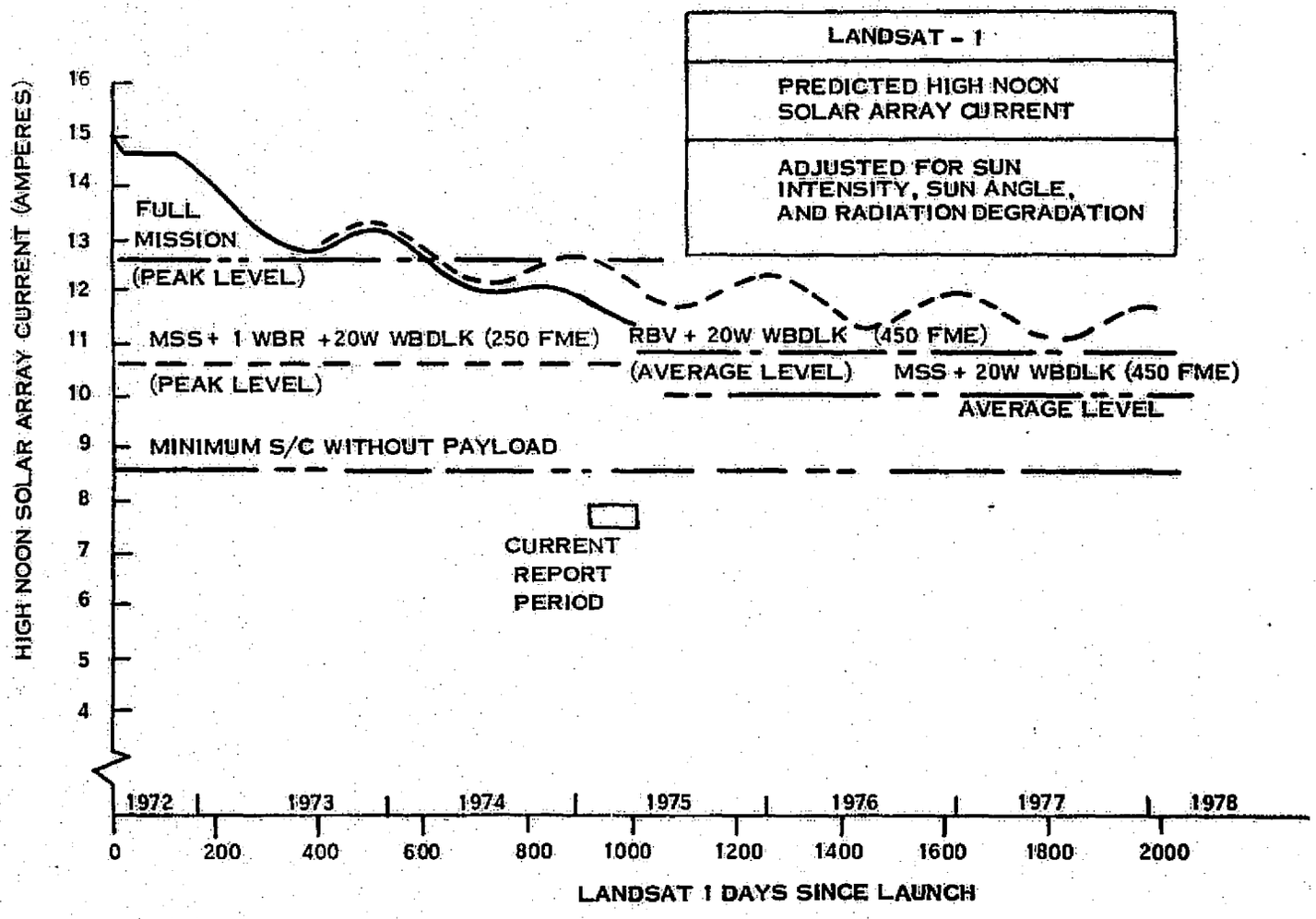


Figure 3-1. LANDSAT-1 Predicted Midday Solar Current

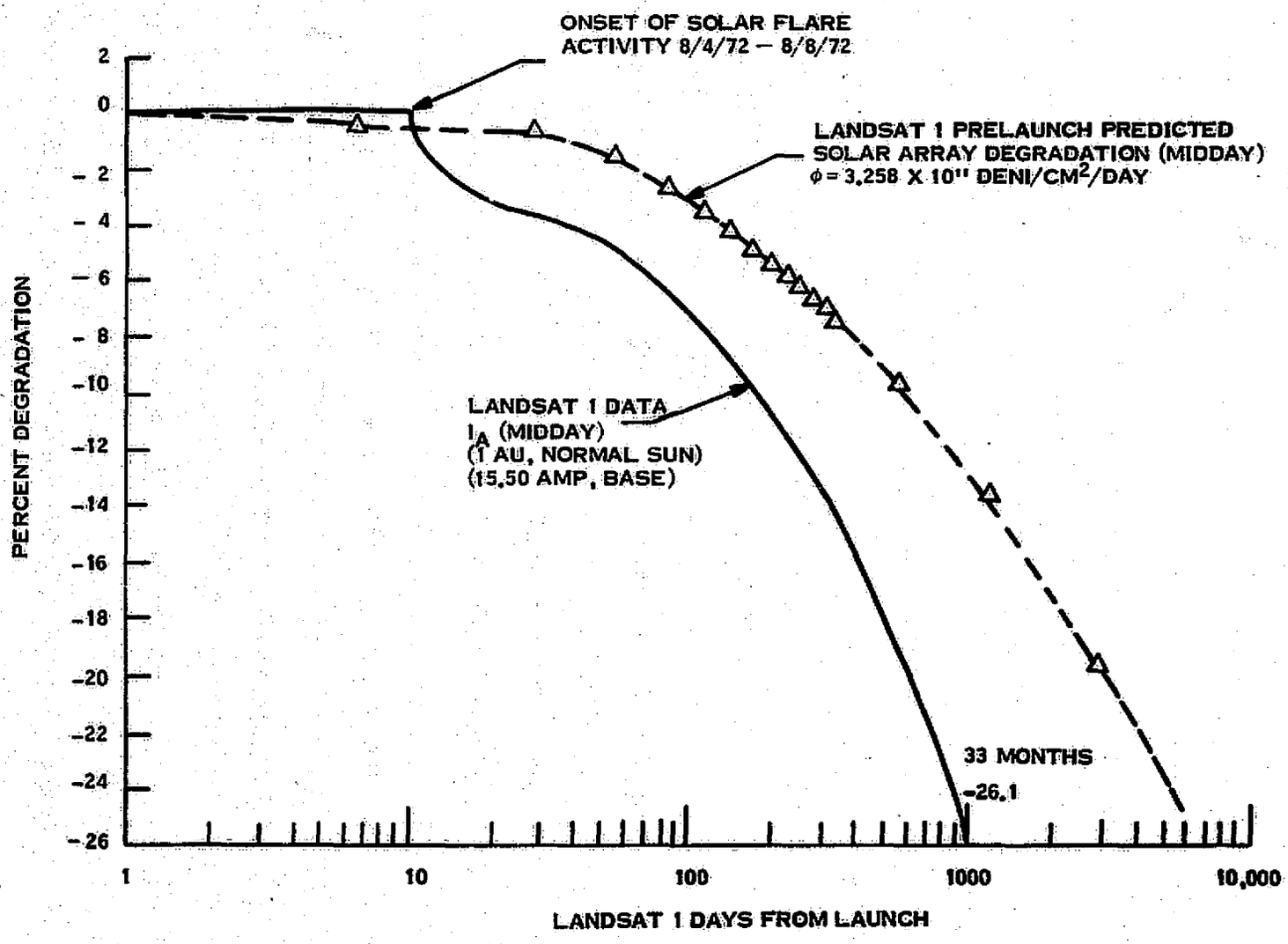


Figure 3-2. IA (Midday) Degradation vs. Days (LANDSAT-1)

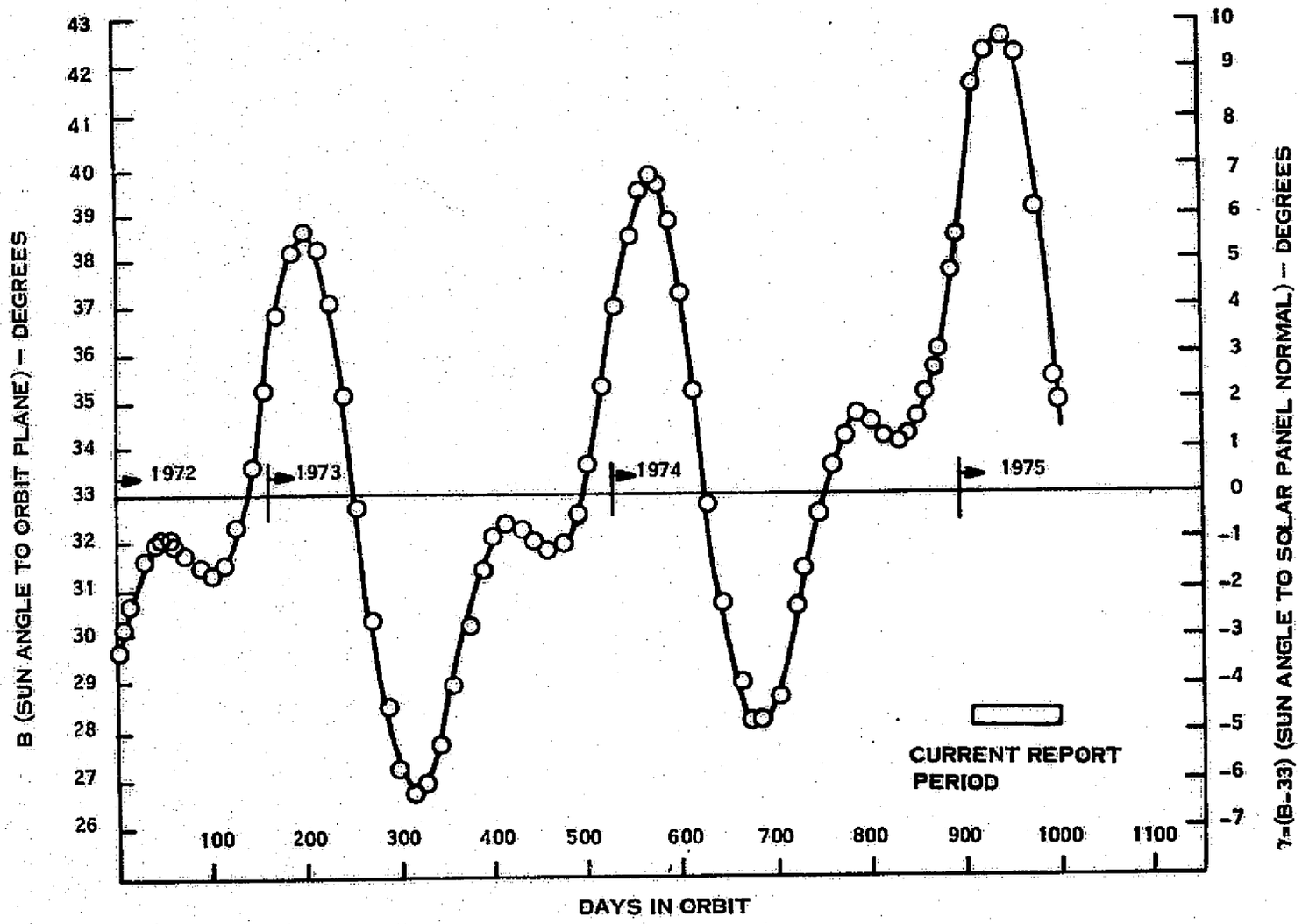
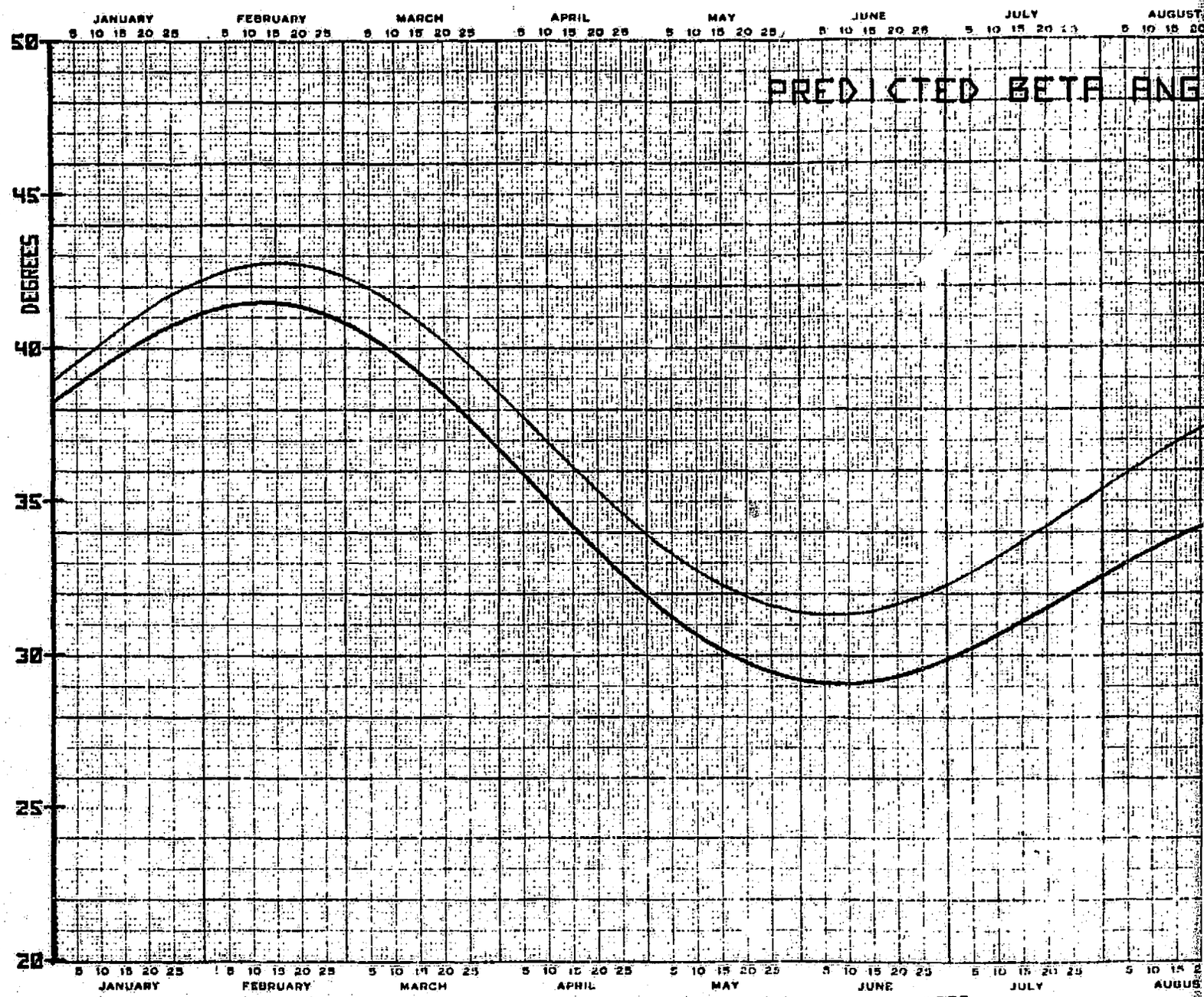


Figure 3-3. Actual and (Paddle) Sun Angles (LANDSAT-1)



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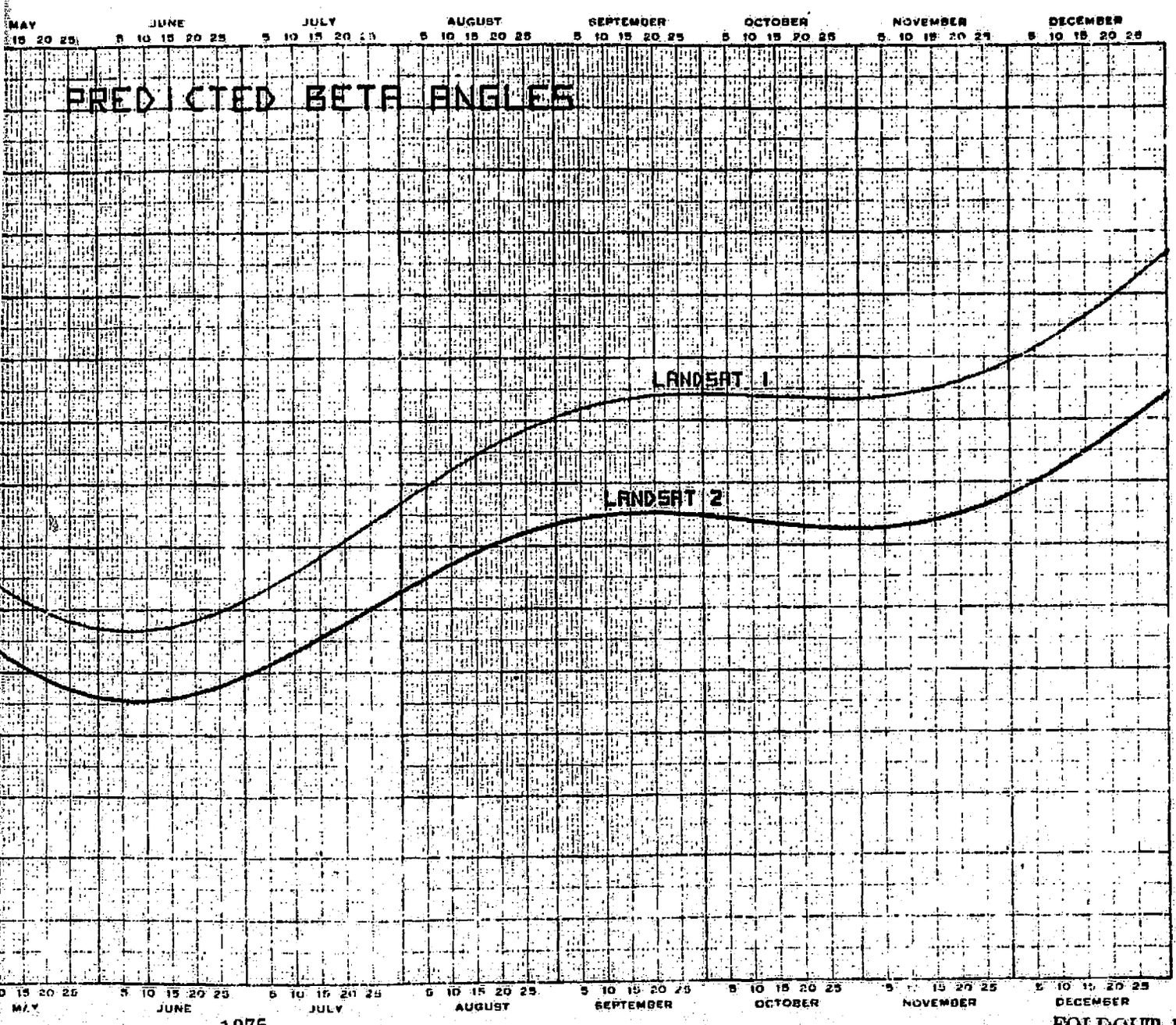

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Figure 3-4. Predicted Beta Angles

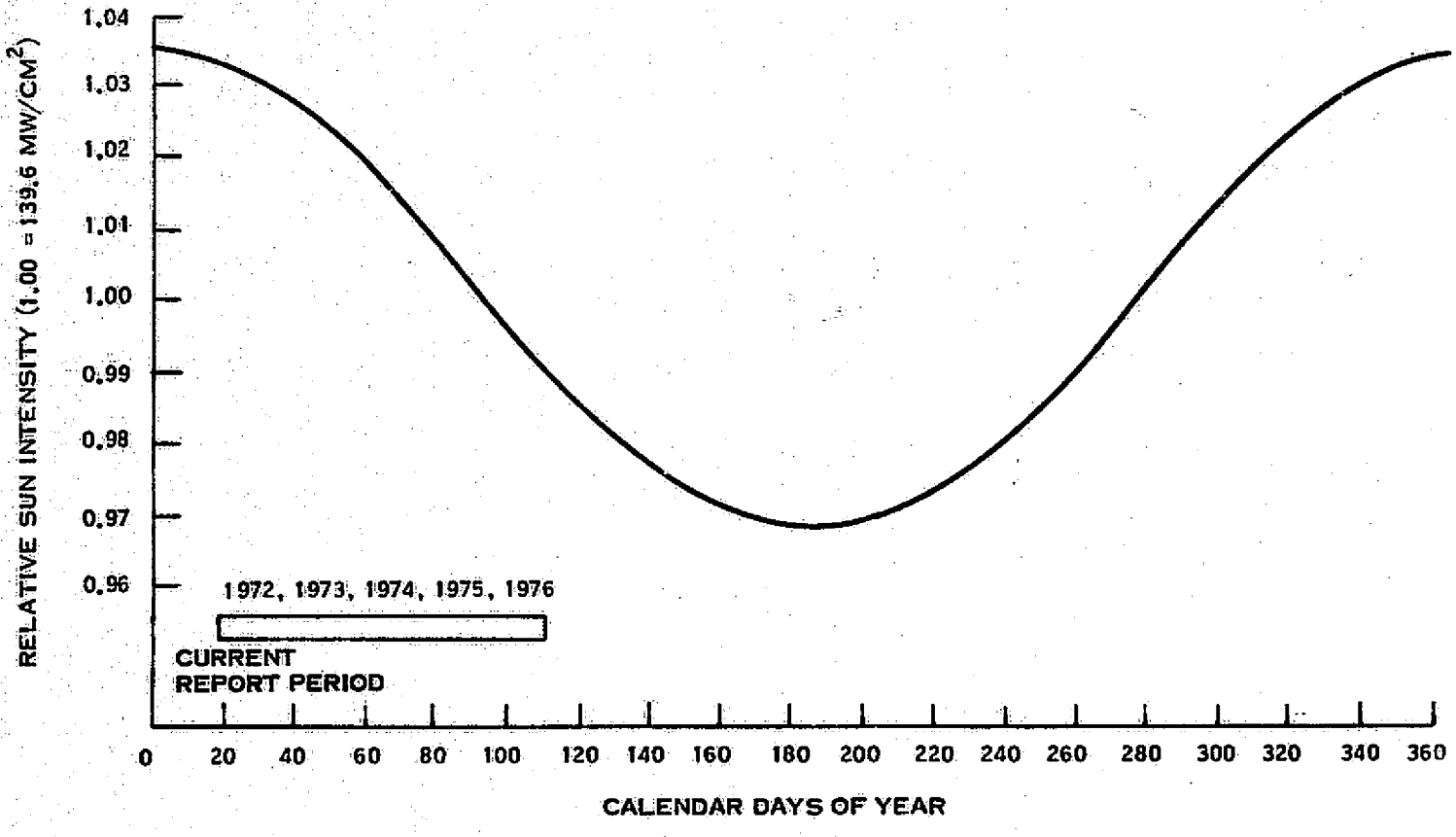


Figure 3-5. Seasonal Solar Intensity Variations

Table 3-1. LANDSAT-1 Major Power Subsystems Parameters

ORBIT NO.		25	2500	5096	7650	10178	13197	13566	13939
BATT 1	MAX	32.48	32.91	* 32.91	32.73	33.25	32.82	32.82	32.82
2	CHGE	32.48	32.91	32.91	32.73	33.16	32.73	32.82	32.73
3	VOLTS	32.48	32.91	32.99	32.73	33.25	32.82	32.82	32.82
4		32.48	32.49	32.99	32.73	33.25	32.82	32.82	32.82
5		32.49	32.99	32.99	32.82	33.33	32.91	32.91	32.91
6		32.31	32.91	32.91	32.73	33.25	32.82	28.72	27.95
7		32.22	32.91	32.91	32.73	33.25	32.82	32.82	32.82
8		32.14	32.91	32.91	32.73	33.25	32.82	32.82	32.82
	AVERAGE	32.38	32.92	32.82	32.75	33.25	32.82	32.32	32.21
BATT 1	END-	28.81	28.12	28.30	28.04	28.98	28.64	28.81	28.64
2	OF-	28.81	28.12	28.30	28.04	28.98	28.64	28.81	28.72
3	NIGHT	28.81	28.04	28.30	28.04	28.98	28.64	28.81	28.64
4	VOLTS	28.69	28.12	28.38	28.04	28.98	28.64	28.81	28.72
5		28.69	28.81	28.38	29.12	29.06	28.72	28.89	28.72
6		28.81	28.04	28.30	27.95	28.98	28.55	28.64	27.27
7		28.81	28.12	28.30	28.04	28.98	28.64	28.81	28.64
8		28.81	28.12	28.30	28.04	28.98	28.64	28.81	28.64
	AVERAGE	28.84	28.11	28.32	28.04	28.99	28.64	28.80	28.57
BATT 1	(*) CHGE	13.11	13.00	* 13.58	13.14	13.96			
2	SHARE	12.93	13.00	* 13.58	*13.14	*13.06	*13.68	*15.15	*15.27
3	(%)	11.36	11.53	11.89	11.65	11.95	11.67	13.71	13.98
4		12.39	12.13	11.95	12.02	12.26	12.44	14.21	14.10
5		12.32	12.41	11.85	12.38	11.93	12.21	13.76	13.38
6		12.80	12.82	12.35	12.84	11.79	11.61	**	**
7		12.62	12.66	12.42	12.55	12.13	12.28	13.69	13.81
8		12.45	12.45	12.10	12.25	11.98	12.44	13.96	14.02
BATT 1	LOAD	12.71	12.61	12.44	12.68	12.58	13.36	14.53	14.55
2	SHARE	12.80	13.43	13.62	13.44	13.70	14.07	15.66	16.19
3	(%)	11.43	12.11	11.91	12.04	12.23	12.50	14.11	14.28
4		12.77	12.88	13.01	12.85	13.12	13.43	14.74	14.61
5		12.54	12.29	12.42	12.41	12.60	13.43	13.70	13.65
6		12.53	12.29	12.21	12.11	11.30	9.81	**	**
7		12.80	12.27	12.41	12.41	12.50	12.30	13.91	13.84
8		12.32	12.12	11.98	12.09	11.97	12.09	13.16	12.67
BATT 1	TEMP	21.11	25.13	24.65	25.31	24.76	24.78	23.98	23.78
2	IN	18.74	22.33	21.42	21.37	20.89	20.00	20.48	20.89
3	(°C)	18.77	20.72	20.29	20.30	20.16	19.07	18.72	19.48
4		21.57	23.23	23.17	23.28	23.32	22.98	22.14	22.39
5		21.82	26.77	23.85	27.62	24.09	25.60	26.39	24.19
6		21.21	26.95	24.37	27.84	24.78	25.63	25.34	23.46
7		21.41	27.18	25.01	27.62	24.96	27.69	26.04	24.79
8		21.82	26.68	25.14	27.01	25.24	26.80	25.77	25.25
	AVERAGE	20.81	24.67	23.49	25.05	23.53	24.83	23.61	23.04
S/C REG BUS PWR (W)		176.8	182.3	183.4	180.0	165.6	87.96	82.96	96.04
COMP LOAD PWR (W) (P/O S/C REG BUS PWR)		49.0	34.8	34.8	34.6	41.9	41.9	29.4	29.4
P/L REG BUS PWR (W)		16.2	36.1	13.7	16.5	8.9	0.25	0.49	0.25
C/D RATIO		1.06	1.08	1.13	1.17	1.21	1.35	1.17	1.10
TOTAL CHARGE (A-M)		309.2	353.85	290.21	*291.5	*258.3	*261.49	*223.11	*223.31
TOTAL DISCHARGE (A-M)		290.9	327.05	256.28	249.0	214.2	194.18	190.26	203.18
SOLAR ARRAY (A-M)		1044	1028	966	934	937	859	842	821
S. A. PEAK I (AMP)		15.8	16.10	13.69	13.68	12.44	12.27	12.35	12.09
MIDDAY ARRAY I (AMP)		15.01	14.21	12.80	NA	NA	11.76	11.52	11.44
SUN ANGLE (DEG)		-3.33	+5.15	-3.56	+5.61	-1.42	8.48	6.79	1.69
MAX R PAD TEMP (°C)		+62.0	+71.00	+68.00	+72.0	63.20	65.6	65.6	64.40
MIN R PAD TEMP (°C)		-62.0	-66.00	-59.00	-56.0	-42.75	-37.32	-39.14	-40.96
MAX L PAD TEMP (°C)		+57.9	+66.00	+60.50	+67.0	56.00	62.00	59.60	57.20
MIN L PAD TEMP (°C)		-67.0	-60.00	-64.00	-60.0	-47.00	-39.75	-41.57	-44.00

* After the telemetry failure in Orbit 4396 Battery 2 charge share was taken equal to Battery 1 charge as an approximation in order to derive a charge share value for each battery.

** Note: Battery 6 remained off from Orbit 13346 through the end of this report period.

Table 3-2. LANDSAT-1 Power Subsystem Analog Telemetry (Average Value for Data Received in NBTR Playback)

Function	Description	Unit	Orbits							
			26	2600	5098	7650	10162	12698	15249	17801
6001	BATT 1 DISC	AMP	0.94	1.23	0.81	1.01	0.81	0.91	0.64	0.75
6002	2		0.95	1.29	*	*	*	*	*	*
6003	3		0.84	1.17	0.78	0.98	0.80	0.84	0.61	0.73
6004	4		0.93	1.23	0.86	1.02	0.86	0.91	0.69	0.76
6005	5		0.92	1.19	0.82	0.98	0.82	0.84	0.67	0.72
6006	6 ++		0.91	1.20	0.76	0.96	0.72	0.84	++	++
6007	7		0.94	1.19	0.82	1.01	0.80	0.82	0.64	0.72
6008	8		0.91	1.19	0.77	0.97	0.78	0.81	0.64	0.68
6011	BATT 1 CHG	AMP	0.58	0.71	0.58	0.49	0.69	0.44	0.53	0.63
6012	2		0.57	0.71	*	*	*	*	*	*
6013	3		0.50	0.63	0.46	0.44	0.60	0.39	0.48	0.58
6014	4		0.54	0.66	0.51	0.45	0.60	0.40	0.50	0.58
6015	5		0.54	0.68	0.50	0.46	0.58	0.40	0.48	0.55
6016	6 ++		0.57	0.70	0.52	0.48	0.56	0.38	++	++
6017	7		0.55	0.70	0.53	0.47	0.60	0.40	0.49	0.56
6018	8		0.55	0.69	0.52	0.46	0.58	0.40	0.49	0.58
6021	BATT 1 VOLT	VDC	30.87	30.74	31.24	31.08	-31.64	-31.19	-31.04	-31.31
6022	2		30.87	30.74	31.25	31.08	-31.66	-13.18	-31.04	-31.31
6023	3		30.87	30.74	31.25	31.08	-31.65	-31.16	-31.04	-31.21
6024	4		30.90	30.77	31.28	31.11	-31.70	-31.21	-31.07	-31.25
6025	5		30.85	30.82	31.33	31.17	-31.75	-31.28	-31.13	-31.30
6026	6 ++		30.86	30.72	31.24	31.07	-31.65	-31.16	-28.70	-27.92
6027	7		30.89	30.76	31.27	31.10	-31.68	-31.21	-31.06	-31.23
6028	8		30.89	30.75	31.27	31.10	-31.68	-31.21	-31.05	-31.22
6031	BATT 1 TEMP	DGC	21.17	25.19	24.48	25.38	26.09	24.87	24.01	23.82
6032	2		18.60	22.44	21.29	21.51	22.61	20.08	20.55	21.03
6033	3		18.76	20.80	20.17	20.36	21.26	19.08	18.77	19.54
6034	4		21.57	23.20	23.01	23.30	23.83	23.00	22.15	22.42
6035	5		21.84	26.86	23.77	27.68	24.78	28.69	26.41	24.24
6036	6 ++		21.24	26.99	24.27	27.95	25.78	28.70	25.40	23.52
6037	7		21.43	27.20	24.80	27.74	26.09	27.77	26.09	24.63
6038	8		21.86	26.75	25.02	27.10	26.21	26.98	25.81	25.28
6040	RT PAD TEMP	DGC	25.82	27.95	27.22	33.79	27.16	34.30	32.40	30.25
6041	R PAD V N	VDC	33.40	33.01	33.85	33.00	34.36	32.94	32.65	33.45
6042	R PAD V N	VDC	33.29	32.43	33.50	32.05	33.60	32.18	31.76	32.62
6044	LT PAD TEMP	DGC	14.14	18.56	16.61	24.89	19.11	27.46	25.42	22.57
6045	L PAD V F	DVC	33.69	33.71	34.16	33.84	34.67	34.00	33.71	34.16
6046	L PAD V G	DVC	33.68	33.73	34.19	33.89	34.72	34.04	33.76	34.20
6050	S/C UR BUS V	VDC	31.24	31.03	31.68	31.50	-32.06	-31.63	-31.36	-31.60
6051	S/C RG BUS V	VDC	24.54	24.54	24.55	24.53	-24.53	-24.54	-24.54	-24.54
6052	AUX REG A V	VDC	23.41	23.46	23.48	23.47	-23.47	-23.46	-23.47	-23.48
6053	AUX REG B V	VDC	23.50	23.50	23.50	23.50	-23.50	-23.50	-23.50	-23.50
6054	SOLAR I	AMP	14.87	13.97	12.69	12.61	11.60	11.45	11.37	11.22
6055 +	S/C RG BUS I	AMP	7.11	7.45	6.27	6.54	6.80	6.04	6.53	6.34
6056 +	S/C RG BUS I	AMP	7.11	7.46	6.27	6.53	6.79	6.04	6.54	6.33
6058	PC MOD T 1	DGC	21.82	23.53	22.23	22.65	23.22	21.50	21.47	21.69
6059	PC MOD T 2	DGC	21.68	23.08	22.53	22.72	23.00	21.85	21.41	21.92
6070	P/L RG BUS V	VDC	24.66	24.67	24.68	24.68	-24.68	-24.68	-24.67	-24.67
6071	P/L UR BUS V	VDC	31.05	30.88	31.53	31.55	-31.92	-31.47	-31.21	-31.46
6072 +	P/L RG BUS I	AMP	0.57	1.47	0.56	0.67	0.36	0.37	0.35	0.37
6073	P AUX A V	VDC	23.51	23.53	23.51	23.51	-23.50	-23.50	-23.50	-23.50
6074	P AUX B V	VDC	23.51	23.53	23.51	23.51	-23.50	-23.50	-23.50	-23.50
6075	PR MOD T 1	DGC	21.50	24.40	23.13	23.36	23.02	22.05	22.56	23.03
6076	PR MOD T 2	DGC	20.34	22.31	21.45	21.62	21.84	20.64	20.84	21.25
6079	FUSE BLOW V	VDC	24.56	**	24.57	24.58	-24.60	-24.59	-24.58	-24.59
6080	SHUNT I I	AMP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6081	2		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6082	3		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6083	4		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6084	5		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6085	6		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6086	7		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6087	8		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6100	P/L RG BUS I	AMP	0.58	1.47	0.56	0.67	0.36	0.37	0.35	0.37
TOTAL NO.	MAJOR FRAMES	NRM	764	425	389	387	384	766	786	788

* Function 6002, 6012: missing data resulted from disabled telemetry resulting from IC chip failure which affected charge current directly and discharge current indirectly via the power computer program.

** Function 6079: missing data resulted from logic error in master information file used in computer processing.

+ FUNC 6055, 6056, 6072 data is derived from Pseudo FUNC 6155, 6156, 6172 used after change to Mode 11

++ BATT 6 was turned off in orbit 13346 and remained so for the rest of this report period

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)
LANDSAT-1

LANDSAT-1's ACS system performed normally and reliably during this report period.

The ACS NORMAL mode has been employed only during the six daily orbits of MSS activity. For the remaining eight daily orbits of non-MSS activity, the spacecraft is commanded into the Roll Diff Tach High Gain mode and Pitch Position Bias (0.0 and +0.6) is employed to maintain the Pitch flywheel's speed between +20 and +100 RPM.

Implementation of this mode of operation became necessary after a Pitch flywheel problem developed in Orbit 11125, (29 September 1974).

This mode of operation has proven to be quite successful in keeping the Roll flywheel unloaded. In addition, pneumatics gating has been almost entirely eliminated, and the total average + Roll gates per week have been reduced to less than one as shown in Figure 4-1. Consequently, the freon remaining useable impulse, 31.49 LB - SEC, should be adequate for at least four more years rather than to March of '76, as previously anticipated.

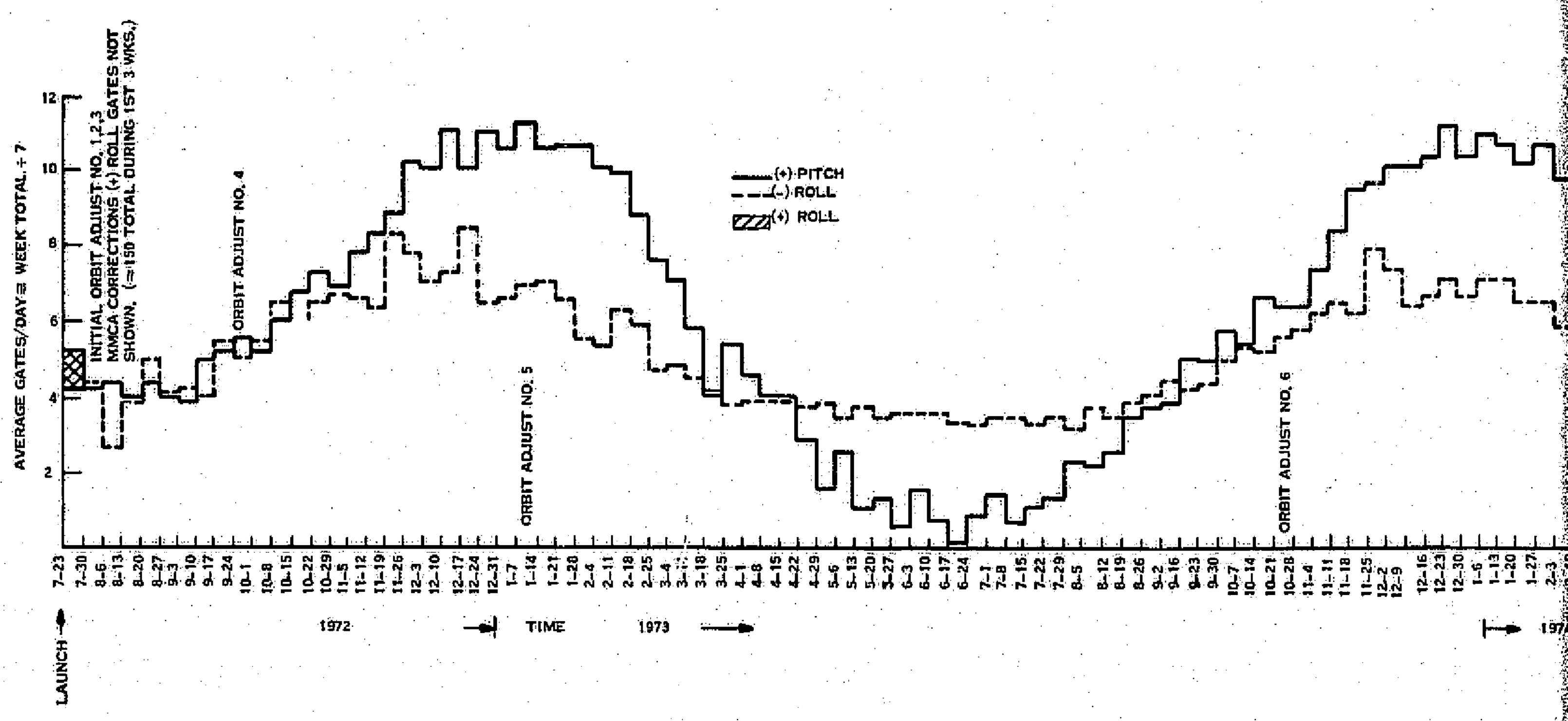
LANDSAT-1's Single Scanner mode was exercised for a portion of Orbit 13922 (18 April 1975) in order to ascertain if MSS sun calibration can be more effectively performed by eliminating transient spacecraft attitude errors emanating from the normal night-to-day transition. Strip charts recorded during this test demonstrated the transient error could be completely removed without effect on the ACS system.

Solar Array Drive voltages, currents, temperatures and cosine pot signals have all been normal.

RMP 1, which replaced RMP 2 in Orbit 11257, is functioning normally.

Pressure/temperature ratios have all been satisfactory. The forward scanner pressure decreased from 3.33 PSIA (Orbit 12749) to 3.08 (Orbit 13970) and is following the leak pattern described in previous reports.

Tables 4-1, 4-2 and 4-3 are a summary of LANDSAT-1 Attitude Control Subsystem telemetry.



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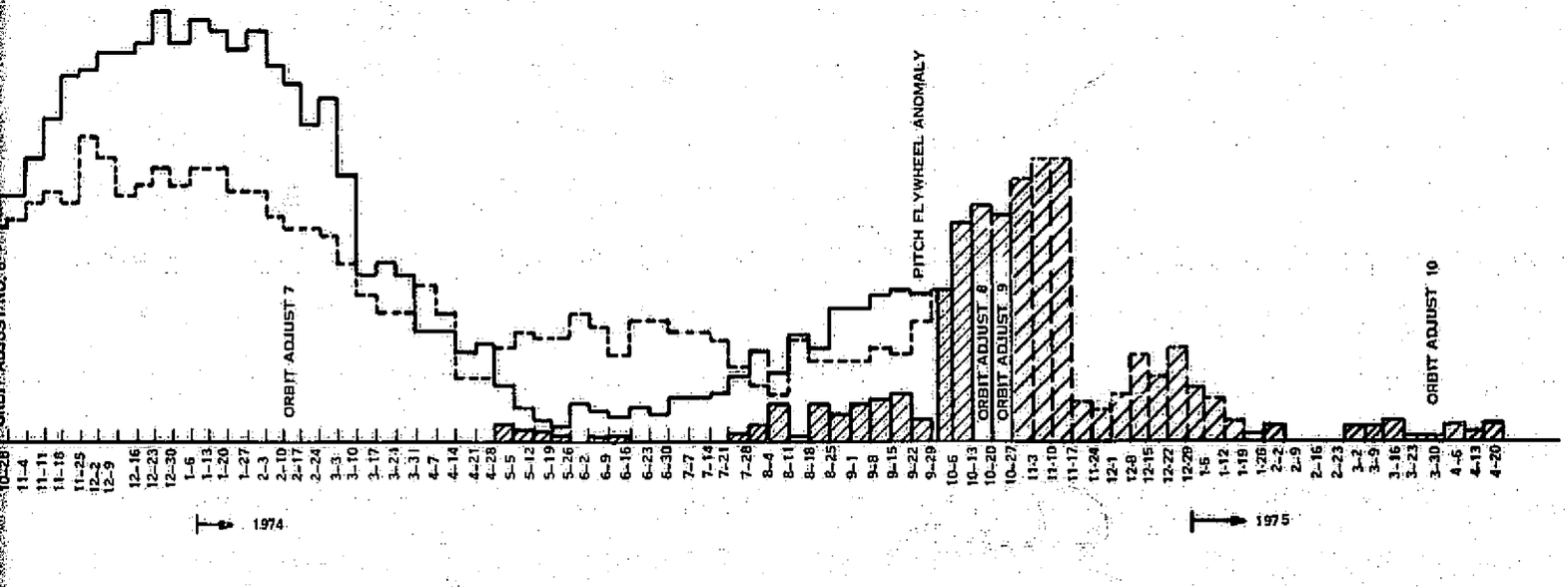

FOLDOUT FRAME 3

Figure 4-1. LANDSAT-1 Gating Frequency vs. Time

FOLDOUT FRAME 4

Table 4-1. LANDSAT-1 ACS Temperature and Pressure Telemetry Summary

Function	Units	Orbit							
		31	2600	5099	7650	10182	13198	13569	14001
1084 RMP 1 Gyro Temperature	DGC	44.5	24.28	23.06	25.21	21.22	42.06	42.13	42.02
1094 RMP 2 Gyro Temperature	DGC	74.3	75.07	75.10	75.42	43.45	24.22	24.17	23.83
1222 SAD RT MTR HSING Temp	DGC	21.1	23.07	22.00	24.29	20.55	22.28	22.32	22.34
1242 SAD LT MTR HSING Temp	DGC	27.0	32.27	30.38	33.44	28.18	29.88	29.66	29.29
1223 SAD RT MTR WNDNG Temp	DGC	25.3	27.39	26.54	28.26	24.63	26.03	26.11	26.40
1243 SAD LT MTR WNDNG Temp	DGC	28.7	34.99	32.92	35.87	30.32	32.29	32.04	31.74
1228 SAD RT HSG Pressure	PSI	7.6	7.53	7.35	7.28	7.12	6.97	6.97	6.95
1248 SAD LT HSG Pressure	PSI	7.0	7.04	6.86	6.76	6.47	6.31	6.31	6.26
1007 FWD Scanner MTR Temp	DGC	19.8	21.35	19.88	22.26	16.46	19.68	19.93	19.86
1016 Rear Scanner MTR Temp	DGC	20.5	21.25	19.83	21.79	17.86	19.15	19.28	19.21
1003 FWD Scanner Pressure	PSI	4.6	4.52	4.02	3.84	3.50	3.17	3.10	3.02
1012 Rear Scanner Pressure	PSI	7.8	8.05	7.67	7.67	7.44	7.19	7.22	7.19
1212 Gas Tank Pressure	PSI	1988.0	1849.00	1702.34	1598.59	1454.19	247.82	241.65	339.58
1210 Gas Tank Temperature	DGC	22.6	26.07	24.30	27.16	22.56	24.21	24.21	24.07
1213 Manifold Pressure	PSI	56.7	57.16	57.44	57.81	58.73	61.26	61.25	61.29
1211 Manifold Temperature	DGC	21.9	25.51	23.62	26.61	21.77	23.72	23.74	23.48
1059 CLB Power Supply Card Temp	DGC	37.1	42.22	40.54	43.34	38.83	40.40	40.47	40.34
1260 ACS Baseplate 1	DGC	25.4	29.71	27.93	31.01	25.36	26.91	26.72	26.32
1261 ACS Baseplate 2	DGC	22.9	26.42	24.73	27.76	23.00	25.03	25.04	24.72
1262 ACS Baseplate 3	DGC	23.4	25.09	23.69	26.24	21.97	24.60	24.62	24.49
1263 THO1 STS	DGC	-6.8	0.59	-0.97	3.97	-3.41	2.98	2.03	1.16
1264 THO2 STS	DGC	-14.6	-8.81	-9.42	-5.85	-8.27	-2.75	-4.00	-4.20
1265 THO3 STS	DGC	-3.1	9.32	9.31	15.52	7.56	16.32	14.75	13.09
1266 THO4 STS	DGC	-13.9	-2.55	2.85	4.46	-1.85	4.00	2.89	1.96
1267 THO5 STS	DGC	-8.9	-0.97	-1.16	6.73	-5.17	5.70	2.99	1.30
1224 SAD R FSST	DGC	39.5	52.87	60.21	61.90	63.25	63.60	62.26	64.65
1244 SAD L FSST	DGC	27.1	45.64	51.11	56.46	53.21	57.21	55.74	55.25

Table 4-2. LANDSAT-1 ACS Voltages and Currents

Function	Units	Orbit							
		31	2600	5099	7650	10182	13198	13569	14001
1057 CLB Power Supply Volts	TMV	2.8	2.79	2.78	2.79	2.78	2.78	2.78	2.78
1081 RMP 1 MTR Volts	VDC	OFF	OFF	OFF	OFF	OFF	-30.14	-30.14	-30.14
1082 RMP 1 MTR Current	Amps	OFF	OFF	OFF	OFF	OFF	0.11	0.11	0.11
1080 RMP 1 Supply Volts	VDC	OFF	OFF	OFF	OFF	OFF	-23.79	-23.78	-23.78
1091 RMP 2 MTR Volts	VDC	-29.7	-29.63	-29.63	-29.59	-29.63	OFF	OFF	OFF
1092 RMP 2 MTR Current	Amps	0.10	0.10	0.10	0.11	0.11	OFF	OFF	OFF
1090 RMP 2 Supply Volts	VDC	-23.4	-23.38	-23.41	-23.38	-23.50	OFF	OFF	OFF
1220 SAD RT MTR WNDNG Volts	VDC	-4.8	-4.32	-4.25	-4.18	-3.69	-3.71	-3.75	-3.71
1240 SAD LT MTR WNDNG Volts	VDC	-4.8	-4.12	-4.09	-3.95	-3.36	-3.25	-3.19	-3.27
1227 SAD RT -15 VDC Conv.	VDC	14.9	14.90	14.88	14.88	14.89	14.88	14.89	14.89
1247 SAD LT -15 VDC Conv.	VDC	15.2	15.15	15.13	15.13	15.14	15.13	15.14	15.13
1056 CLB ± 6 VDC	TMV	2.4	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1055 CLB + 10 VDC TMV	TMV	2.75	2.75	2.75	2.75	2.74	2.78	2.74	2.74

Table 4-3. LANDSAT-1 ACS Attitude Errors and Driver Duty Cycles

Function	Units	Orbits		
		13198	13569	14001
1141 Pitch Fine-Error	DEG	-0.40	-0.08	-0.02
1143 Pitch Flywheel Speed	RPM	-10.49	-26.86	-1.21
1038 Pitch MTR DRVR CCW	PCT	4.96	5.81	4.55
1039 Pitch MTR DRVR CW	PCT	2.29	2.17	5.10
1030 Roll Fine Error	DEG	-2.25	-0.20	-0.20
1127 Roll Rear Flywheel Speed	RPM	715.78	756.92	782.08
1126 Roll Fwd Flywheel Speed	RPM	641.82	674.47	693.31
1022 Roll Rear MTR DRVR CCW	PCT	0.01	0.68	0.90
1025 Roll Rear MTR DRVR CW	PCT	4.26	5.22	5.52
1023 Roll Fwd MTR DRVR CCW	PCT	0.01	0.66	0.72
1024 Roll Fwd MTR DRVR CW	PCT	4.15	4.94	5.35
1035 Yaw Tach	RPM	-206.08	-116.50	-93.72
1033 Yaw MTR DRVR CW	PCT	0.04	1.53	1.84
1034 Yaw MTR DRVR CCW	PCT	0.70	1.60	1.76
1221 SAD Right Tach	DEG/MIN	3.37	3.37	2.81
1241 SAD Left Tach	DEG/MIN	2.80	2.81	2.81

NOTE: Tabulation of these functions began after the pitch flywheel anomaly (stopped) in orbit 11125.

SECTION 5

COMMAND CLOCK SUBSYSTEM (CMD)

The Command and Clock Subsystem consists of A and B units of: Command Clock, Command Decoders, Comstors, Matrix Decoders, Matrix Drivers, Time Code and Frequency Generators and VHF Receivers plus a Command Execute Counter and switching equipment.

Command processing for both real time and stored commands has been nominal during this period.

Rare commanding difficulties that have been experienced have been isolated to ground transmission problems.

Missed real time commands, attributed to the logic race in the command clock design, are occasionally noted. On rare occasions stored commands are blocked by a real time sequence being transmitted during the stored command time tag.

The spacecraft time base provided by the time code generator has been well within specifications. The clock has been reset five times in orbit: at the beginning of 1973 during Orbits 2249 and 2274; in August 1973 during Orbit 5578; at the beginning of 1974 during Orbit 7339; and at the beginning of 1975 during Orbit 12429 (Figure 5-1). The S/C clock consistently loses time, as shown by the negative slope in Figure 5-1. The slope decreases with time. These slopes are plotted in Figure 5-2, which shows that the drift rate decreases with time.

Table 5-1 gives typical telemetry values, all nominal.

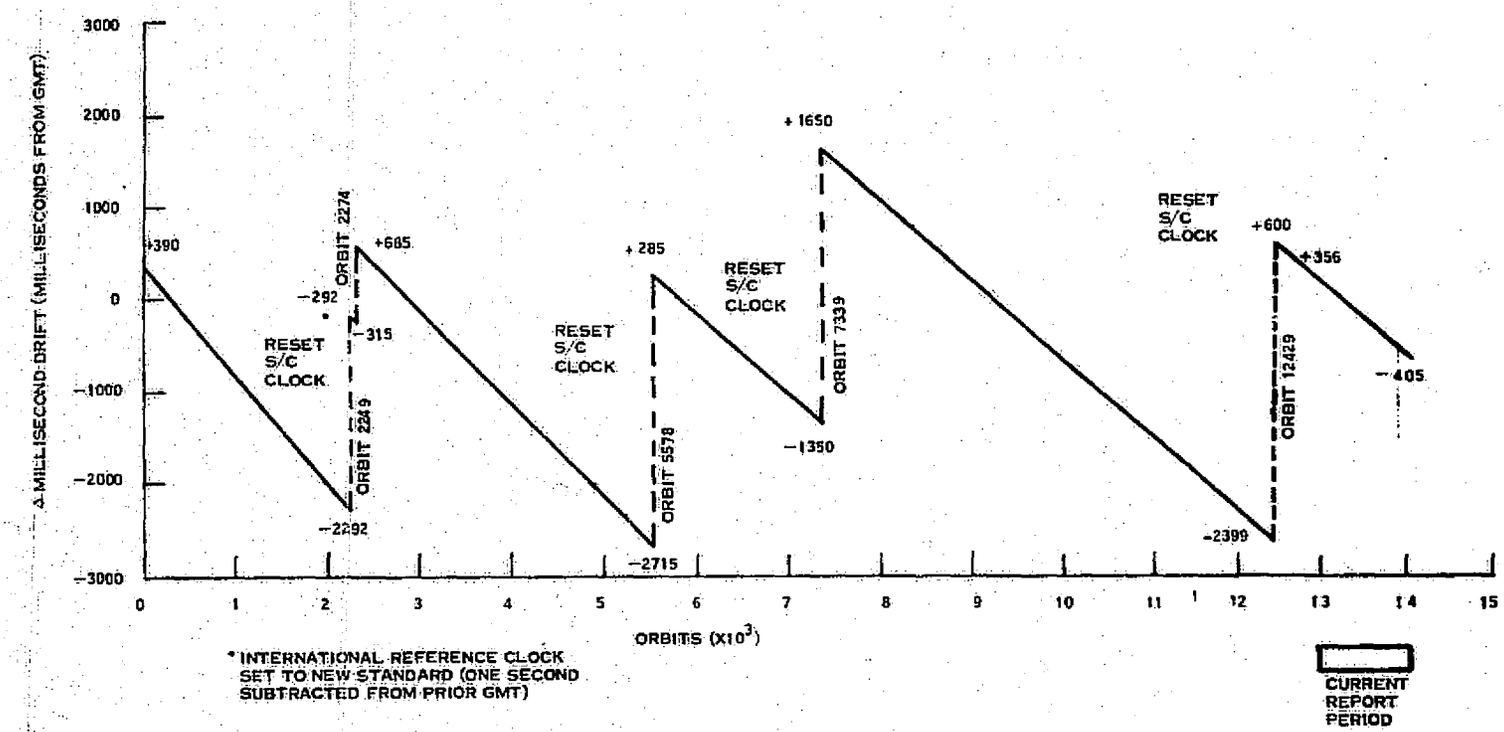

Figure 5-1. LANDSAT-1 Spacecraft Clock Drift History

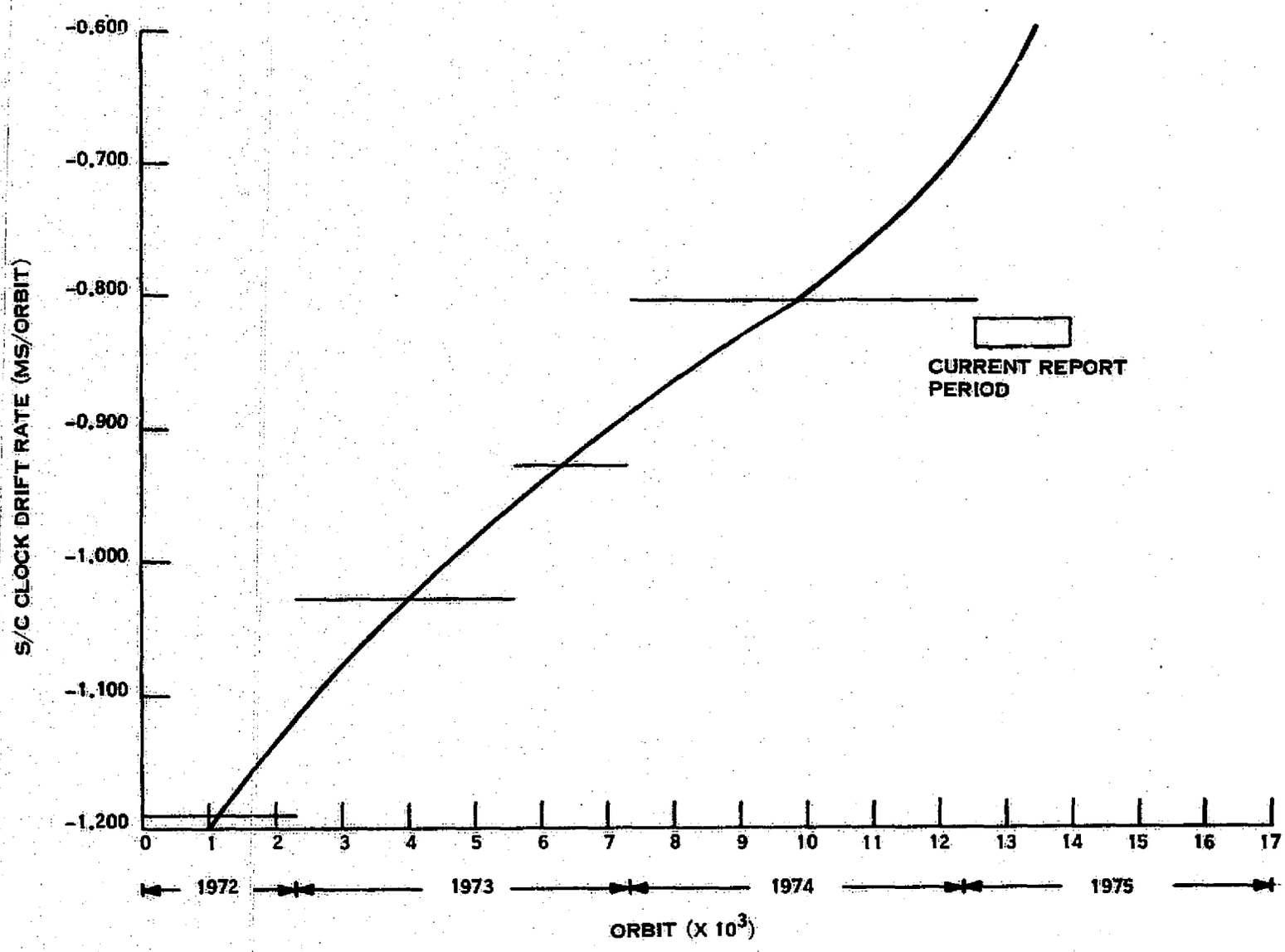

Figure 5-2. LANDSAT-1 Spacecraft Clock Drift Rate

Table 5-1. Command Clock Telemetry Summary

Function No.	Name	Mode	Units	Orbit					
				35	5095	10182	13198	13569	14001
8005	Pri. Power Supply Temp	-	°C	37.31	39.37	39.50	39.03	38.47	38.65
8006	Red. Power Supply Temp	-	°C	35.73	38.08	38.38	38.16	37.48	37.80
8007	Pri. Osc. Temp	-	°C	31.14	31.98	32.31	31.97	31.12	31.44
8008	Red. Osc. Temp	-	°C	30.47	31.39	31.42	31.40	30.48	30.67
8009	Pri. Osc. Output	-	TMV	0.95	0.96	0.97	0.97	0.90	0.91
8010	Red. Osc. Output	-	TMV	**	**	**	**	**	**
8011	100 kHz	Pri. - Red.	TMV	3.11	3.10	3.11	3.11	3.11	3.11
8012	10 kHz	Pri. - Red.	TMV	3.10	3.07	3.08	3.08	3.08	3.08
8013	2.5 kHz	Pri. - Red.	TMV	2.95	2.95	2.95	2.95	2.95	2.95
8014	400 Hz	Pri. - Red.	TMV	4.40	4.40	4.40	4.40	4.40	4.40
8015	Pri. +4V Power Supply	Pri. Clk ON	VDC	4.10	4.10	4.10	4.10	4.10	4.10
8016	Red. +4V Power Supply	Red. Clk ON	VDC	3.95	3.95	3.95	3.95	3.94	3.94
8017	Pri. +6V Power Supply	Pri. Clk ON	VDC	6.06	6.07	6.07	6.07	6.07	6.07
8018	Red. +6V Power Supply	Red. Clk ON	VDC	6.00	5.94	5.94	6.03	5.94	5.94
8019	Pri. -6V Power Supply	Pri. Clk ON	VDC	-6.02	-6.02	-6.03	-6.02	-6.03	-6.03
8020	Red. -6V Power Supply	Red. Clk ON	VDC	-5.95	-6.00	-6.00	-5.89	-6.00	-6.00
8021	Pri. +23V Power Supply	Pri. Clk ON	VDC	-22.88	-22.89	-22.89	-22.88	-22.90	-22.88
8022	Red. +23V Power Supply	Red. Clk ON	VDC	-22.98	-23.00	-23.01	-23.00	-23.00	-23.00
8023	Pri. +29V Power Supply	Pri. Clk ON	VDC	-29.13	-29.16	-29.15	-29.15	-29.15	-29.15
8024	Red. +29V Power Supply	Red. Clk ON	VDC	-29.07	-29.21	-29.21	-29.22	-29.21	-29.21
8101	CIU A -12V	CIA A ON	VDC	-12.33	-12.33	-12.34	-12.35	-12.34	-12.34
8102	CIU B -12V	CIU B ON	VDC	-12.26	-12.28	-12.23	-12.23	-12.22	-12.22
8103	CIU A -5V	CIU A ON	VDC	-5.32	-5.34	-5.34	-5.34	-5.36	-5.34
8104	CIU B -5V	CIU B ON	VDC	-5.31	-5.31	-5.31	-5.31	-5.31	-5.31
8105	CIU A Temp	CIU A ON	°C	24.47	24.77	25.04	25.00	24.37	24.65
8106	CIU B Temp	CIU B ON	°C	24.96	25.31	25.45	25.38	24.74	24.96
8201	Receiver RF-A Temp	-	°C	**	**	28.67	28.24	27.51	27.93
8202	Receiver RF-B Temp	-	°C	27.96	28.22	**	**	**	**
8203	D MOD A Temp	-	°C	25.41	25.73	27.98	27.74	26.96	27.45
8204	D MOD B Temp	-	°C	25.03	25.61	26.12	25.71	24.91	25.38
8205	Receiver A AGC	Receiver A ON	DBM	**	**	-96.77	-90.83	-91.42	-86.50
8206	Receiver B AGC	Receiver B ON	DBM	-94.74	-84.67	**	**	**	**
8207	Amp. A Output	Receiver A ON	TMV	**	**	2.31	2.64	2.63	2.73
8208	Amp. B Output	Receiver B ON	TMV	2.81	3.22	**	**	**	**
8209	Freq. Shift Key A OUT	Receiver A ON	TMV	**	**	1.10	1.12	1.11	1.10
8210	Freq. Shift Key B OUT	Receiver B ON	TMV	1.10	1.11	**	**	**	**
8211	Amp. A Output	Receiver A ON	TMV	**	**	1.10	1.12	1.12	1.11
8212	Amp. B Output	Receiver B ON	TMV	1.13	1.13	**	**	**	**
8215	D MOD A -15V	Receiver A ON	TMV	**	**	5.00	5.00	5.00	5.00
8216	D MOD B -15V	Receiver B ON	TMV	5.00	5.00	**	**	**	**
8217	Regulator A -10V	Receiver A ON	TMV	**	**	5.40	5.40	5.39	5.40
8218	Regulator B -10V	Receiver B ON	TMV	5.50	5.50	**	**	**	**

**Units not in use

SECTION 6

TELEMETRY SUBSYSTEM (TLM)

The Telemetry Subsystem consists of A and B units of: Memory, Sequencer, Formatter, Multiplexer, Converter Multiplexer, Preregulators, Transmitter Buffers, and VHF Transmitters, in addition to a single reprogramming unit and switching circuits.

The Narrow Band Telemetry Subsystem samples, encodes, formats, and transmits data from spacecraft service and payload systems to earth receiving stations. The TLM processes and transmits a VHF signal containing this data. It supplies data to the USB Subsystem for transmittal, and provides timing and synchronizing signals to spacecraft service and payload subsystems.

The Telemetry Subsystem has been operating continuously since launch. Typical telemetry values are given in Table 6-1. Memory Section 0, 0 was used in the telemetry matrix thru Orbit 12565, after which it was switched to the 1, 1 mode. Total performance has been normal except for one integrated circuit chip failure in Orbit 4396, containing four functions (6012, 1011, 12238, 7010).

The VHF transmitter unit consists of two redundant Amplifier/Modulator/Output units, A and B, capable of either 0.3 watts or 2 watts output, together with Modulator Filters, switching equipment to select real time or playback telemetry modulation, and an omnidirectional vertical stub antenna centrally located on top of the spacecraft. The transmitter is ON full time, normally transmitting real time (1-kilobit) telemetry data. In an emergency, it can be commanded to the 2.0 watt mode and switched to playback (24 kilobit) data, or to carrier only for use by the Mini-track Stations.

Only transmitter unit A has been used since launch. It has operated flawlessly. Figure 6-1 shows the history of the AGC level in the Alaska ground station for identical spacecraft position and orientation. Since launch, nearly 3 years ago, its loss in power delivered to the ground station has been about 1 db. Referring to Figure 6-1, a signal of -104 dbm would leave a link margin of 6 dbm in the worst case (24 kilobit modulation), providing the 85 foot antenna is used.

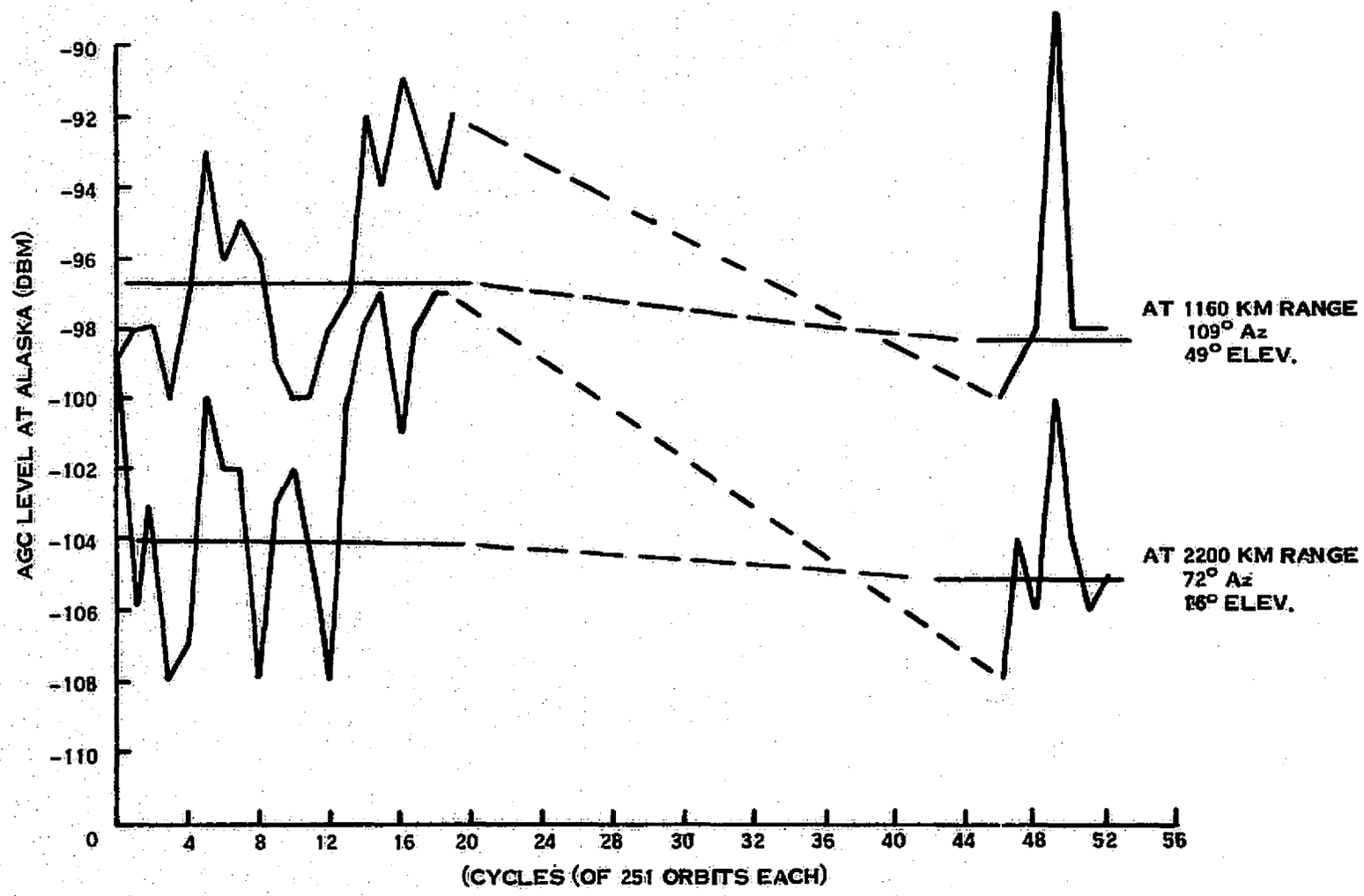

Figure 6-1. Power Received at Alaska from VHF Transmitter A (0.3 Watts) - LANDSAT-1

Table 6-1. TLM Telemetry Summary

Function No.	Function Name	Unit	Orbit						
			35	2600	5099	7850	10592	13190	13389	14081
9001	Memory Sequencer A Converter	VDC	6.35	6.34	6.33	6.33	6.33	6.34	6.34	6.33
9002	Memory Sequencer B Converter	VDC	**	**	**	**	**	**	**	**
9003	Memory Sequencer Temp.	°C	19.59	21.47	21.06	22.67	21.30	23.24	21.65	21.48
9004	Formatter A Converter	VDC	5.99	5.99	5.99	5.99	5.99	6.02	5.99	5.99
9005	Formatter B Converter	VDC	**	**	**	**	**	**	**	**
9006	Dig. Mux A Converter	VDC	10.01	10.07	10.06	10.07	10.07	10.02	10.07	10.07
9007	Dig. Mux B Converter	VDC	**	**	**	**	**	**	**	**
9008	Formatter/Dig. Mux Temp.	°C	22.50	27.34	24.89	27.97	25.0	29.24	27.09	24.92
9009	Analog Mux A Converter	VDC	26.01	26.18	26.18	26.18	26.20	26.24	26.26	26.29
9010	Analog Mux B Converter	VDC	**	**	**	**	**	**	**	**
9011	A/D Converter A Voltage	VDC	10.00	10.07	10.07	10.07	10.07	10.07	10.07	10.07
9012	A/D Converter B Voltage	VDC	**	**	**	**	**	**	**	**
9013	Analog Mux/A/D Converter	°C	25.90	27.50	26.83	29.43	27.49	30.00	27.48	27.22
9014	Preregulator A Voltage	VDC	19.93	19.89	19.91	19.19	19.94	20.00	19.90	19.95
9015	Preregulator B Voltage	VDC	**	**	**	**	**	**	**	**
9016	Reprogrammer Temp.	°C	23.00	25.00	22.50	26.05	23.53	26.92	24.61	24.04
9017	Memory A Converter	VDC	6.00	6.00	5.99	6.00	6.00	6.00	5.97	5.97
9018	Memory A Temp.	°C	17.51	19.06	17.50	19.00	17.50	19.09	17.73	18.19
9019	Memory B Converter	VDC	**	**	**	**	**	**	**	**
9020	Memory B Temp.	°C	17.66	19.29	17.63	19.62	17.51	19.67	18.52	18.15
9100	Reflected Power (Xmtr A)	dBm	11.95	12.75	12.32	13.11	12.38	13.18	12.75	12.34
9101	Xmtr A -20 VDC	VDC	-19.75	-19.78	-19.76	-19.75	-19.75	19.79	19.77	19.77
9102	Xmtr B -20 VDC	VDC	**	**	**	**	**	**	**	**
9103	Xmtr A Temp.	°C	20.95	24.06	21.14	25.24	22.01	27.29	24.69	22.39
9104	Xmtr B Temp.	°C	21.49	25.02	21.95	26.36	22.76	28.55	25.60	23.05
9105	Xmtr A Power Output	dBm	25.12	25.36	25.25	25.38	25.24	25.36	25.27	25.24
9106	Xmtr B Power Output	dBm	**	**	**	**	**		**	

** Units not used since prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem has been fired ten times, seven times using the -X thruster and three times using the +X thruster. Three -X firings were for initial orbit correction and four -X for orbit maintenance. The three +X firings were for orbit maintenance. The only orbit maintenance maneuver in this report period occurred in Orbit 13611 utilizing the +X thruster. The burn lasted for 2.8 seconds and performance was normal in all respects. The ACS pneumatics was not enabled during this maneuver in view of the short duration of the burn and the low availability of freon. The Subsystem pressure/temperature parameters continue to be normal. There is 64.86 pounds of hydrazine fuel remaining from an initial prelaunch load of 67.00 pounds. Figure 2-2 shows spacecraft ground track drift from standard orbit tracks and the effects of orbit adjustment. Table 7-1 is a summary of OAS performance to date, and Table 7-2 gives average telemetry values for the off quiescent state.

Table 7-1. LANDSAT-1 Orbit Adjust Summary

Orbit	Orbit Adjust No.	Ignition Epoch	Burn Duration (Seconds)	(Meters)	Engine Performance Efficiency	Fuel[1] Used (Lbs)	Tank Pressure (PSIA)	Tank Temperature (°F)	Axis Thruster
38	1.	26 Jul 72 11:25:0.0	4.8	12	60%	2.15	540.0	75.0	-X
44	2.	26 Jul 72 21:44:46	250.0	1975	103.4%		U[2]	U[2]	-X
59	3.	27 Jul 72 23:34:45	318.0	2391	101.5%		516.0	73.9	-X
938	4.	29 Sep 72 00:30:00	11.8	98	110.0%	0.039	U[2]	U[2]	-X
2416	5.	13 Jan 73 00:21:30	20.4	154	106.0%	0.071	489.4	75.4	-X
6390	6.	25 Oct 73 00:04:10.8	14.8	110	100.0%	0.048	486.8	73.9	-X
7826	7.	4 Feb 74 23:27:10.4	14.8	112	101.8%	0.048	490.59	75.4	-X
11367	8.	16 Oct 74 22:42:10.8	8.0	-65	106.0%	0.026	490.59	74.0	+X
11464	9.	23 Oct 74	8.4	-66	102.0%	0.027	490.59	73.9	+X
13611	10.	26 Mar 75 19:39:00.8	2.8	-22.6	102.7%	0.01	486.86	70.9	+X

[1]Initial Fuel Capacity - 67#

[2]Unavailable

Table 7-2. LANDSAT-1 OAS Telemetry Values

Function No.	Name	Units	Orbit							
			35	2600	5099	7650	10182	13198	13565	14001
2001	Prop. Tank Temp.	°C	22.03	23.91	22.86	24.53	23.28	24.94	22.55	22.15
2003	Thrust Chamber No. 1 (-x) Temp. (1)	°C	29.57	28.50	29.93	27.77	30.55	27.74	26.36	29.50
2004	Thrust Chamber No. 2 (+x) Temp. (1)	°C	38.76	33.74	40.28	39.27	38.91	38.12	37.56	38.28
2005	Thrust Chamber No. 3 (-y) Temp. (1)	°C	34.55	46.23	34.41	47.52	36.09	51.42	46.87	40.63
2006	Line Pressure	psia	539.29	486.87	486.87	491.10	490.61	497.84	490.07	486.93

(1) Wide spread of temperature is due to nozzle locations and satellite day/night transitions relative to data averaged. Typical orbital range is from 19 to 59 DGC.

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The spacecraft was corrected for unbalanced magnetic moments in Orbits 73, 85, 110, 220, 11181, 11185, and 11186, as reported in early reports. Adjustments were made in the yaw negative dipole in Orbit 11186 and the pitch positive dipole in Orbit 220. A short roll dipole test was performed in Orbit 11185, with roll dipole returned to near zero. No adjustments were made in this report period.

The current dipole values are:

Pitch	+2950 Pole-Cm
Roll	-500 Pole-Cm
Yaw	-3600 Pole-Cm

Telemetry measurement shown in Table 8-1 shows that the dipoles are holding steady without drift.

Table 8-1. MMCA Telemetry Summary (LANDSAT-1)

Number	Name	Units	Orbits							
			35	2600	5099	7650	10182	13198	13569	14001
4001	A1 Board Temp	°C	19.77	19.37	19.03	19.12	19.11	18.67	17.66	18.13
4002	A2 Board Temp	°C	23.58	23.36	23.05	23.15	23.13	22.72	21.86	22.29
4003	Hall Current	TMV	3.48	3.49	3.48	3.48	3.48	3.48	3.48	3.48
4004	Yaw Flux Density	TMV	3.11	3.10	3.11	3.13	3.15	4.01	4.01	4.01
4005	Pitch Flux Density	TMV	3.13	2.50	2.51	2.52	2.52	2.52	2.52	2.52
4006	Roll Flux Density	TMV	3.19	3.20	3.19	3.19	3.20	3.28	3.28	3.28

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR (USB/PMP)

The Unified S-Band Equipment (USBE) consists of two S-Band transmitter/receiver pairs (transponders). Each transmitter/receiver pair normally operates as a separate unit. Only one of the two is powered at any given time. The USB Receiver receives the uplink RF signal, demodulates the command and ranging subcarriers, and, when possible, provides a phase-locked oscillator signal for the down-link USB transmitter. A ranging (pseudo-random noise-PRN) signal is demodulated and is available for modulation of the downlink upon ground command. The subcarrier containing command information is sent to the PMP. One of the USB receivers is powered at all times. The USB transmitter uses either the phase-locked oscillator of the USB receiver or, if sufficient signal for phase-lock is not present, an auxiliary oscillator for the transmitter RF driver. Back-up modes allow and sometimes require use of the auxiliary oscillator or the receiver oscillator (phase-locked or free-running) at all times. Modulation of the USB transmitter comes from the PMP, and may or may not have the PRN ranging signal added. Switching permits either transmitter to be ON or OFF, but both transmitters ON simultaneously is not possible. Protection against lengthy inadvertent operation of either transmitter (and/or either of the wide band power amplifiers) is provided by a 32-minute cutoff timer.

The Unified S-Band (USB) Subsystem has operated satisfactorily since launch, despite repeated and large drops in transmitter power output of the A-section. The B-section of the USB dual installation was substituted during Orbit 10068, restoring full 1.5 watts output from the 0.14 watts to which the A-section transmitter had declined, as shown in Figure 9-1.

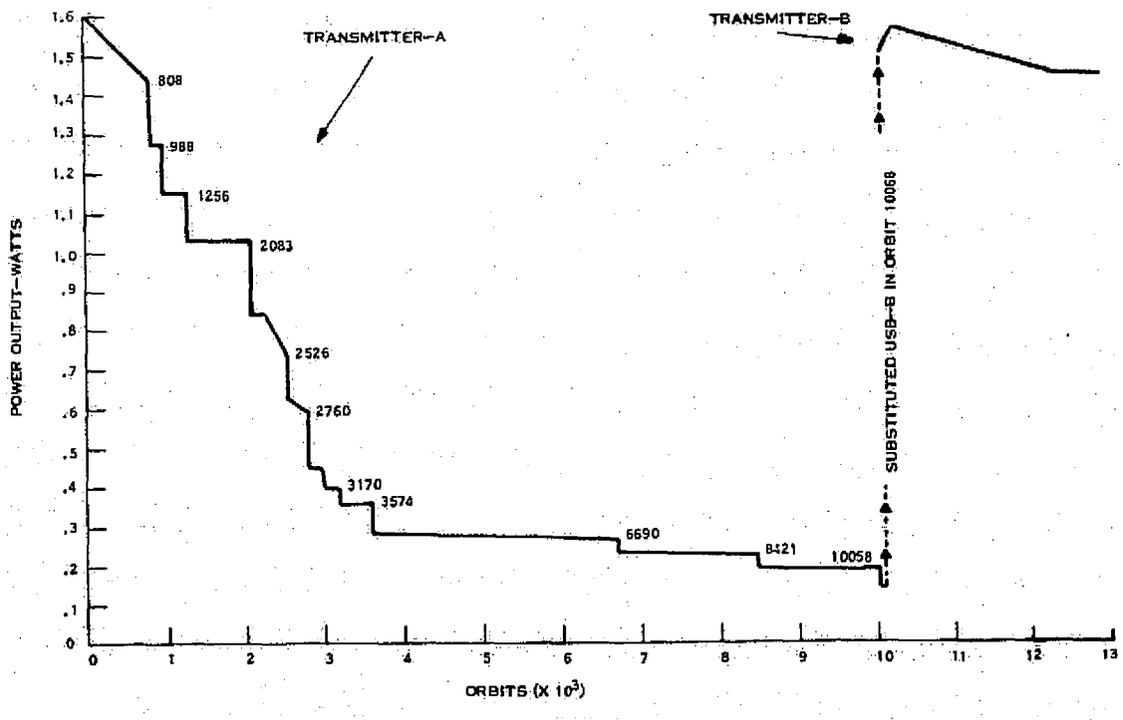

Figure 9-1. USB Power Output History (LANDSAT-1)

The USB-A Receiver was ON continuously from launch to mid Orbit 10068, for a total of 17,327 hours. The A-section transmitter was ON only during station passes from launch to mid Orbit 10068 for a total of 2253 hours. It was commanded ON for transmission of real-time telemetry, playback of stored telemetry, ranging data, and for relay of DCS data.

The B-section receiver has been on continuously since mid Orbit 10068 for a total of 9436 hours. The B-section transmitter has been ON for a total of 1227 hours.

Table 9-1 lists telemetry values, all normal and typical for this reporting period.

Table 9-1. LANDSAT-1 USP/PMP Telemetry Values

Function			Orbit						
No.	Name	Units	35	2565	5099	10592	13198	13569	14001
11001	USB Rcvr AGC	DBM	-122.78	-126.18	-131.99	-129.81	-129.87	-126.38	-128.45
11002	USB Xmtr Pwr	WTS	1.60	0.62	0.29	1.54	1.47	1.47	1.51
11003	USB Rcvr Error	KHZ	21.79	-20.87	-21.32	-23.25	-21.46	-20.82	-21.54
11004	USB Xpond Temp	DGC	22.92	25.30	22.64	25.64	28.20	26.83	25.70
11005	USB Xpond Press	PSI	15.91	16.09	15.91	15.92	16.16	16.03	15 94
11007	USB Xmtr A -15V	VDC	-15.20	-15.20	-15.20	**	**	**	**
11008	USB Xmtr B -15V	VDC	**	**	**	-15.20	-15.20	-15.20	-15.20
11009	USB Range -15V	VDC	-14.76	-14.76	-14.76	-14.58	-14.58	-14.58	-14.58
11101	PMP Pwr A Volt	VDC	-15.12	-15.18	-15.18	**	**	**	**
11102	PMP Pwr B Volt	VDC	**	**	**	-15.12	-15.14	-15.09	-15.10
11103	PMP Temp A	DGC	30.44	33.70	30.23	26.60	31.74	29.07	26.63
11104	PMP Temp B	DGC	**	**	**	31.64	36.08	33.83	31.59

** Unit turned off.

Figure 9-2 shows AGC readings at Goldstone for a constant reference orbit in each cycle since launch. All data are taken, therefore, at the same range, elevation, and azimuth. The AGC difference (8 dB) between the curves is caused by the dual effects of doubling the distance (6 dB) and the USB antenna pattern. The effect of the USB transmitter-A power decline can be seen through 38 cycles, and then the rise caused by substituting the higher powered B-transmitter (10 dB) through cycle 42.

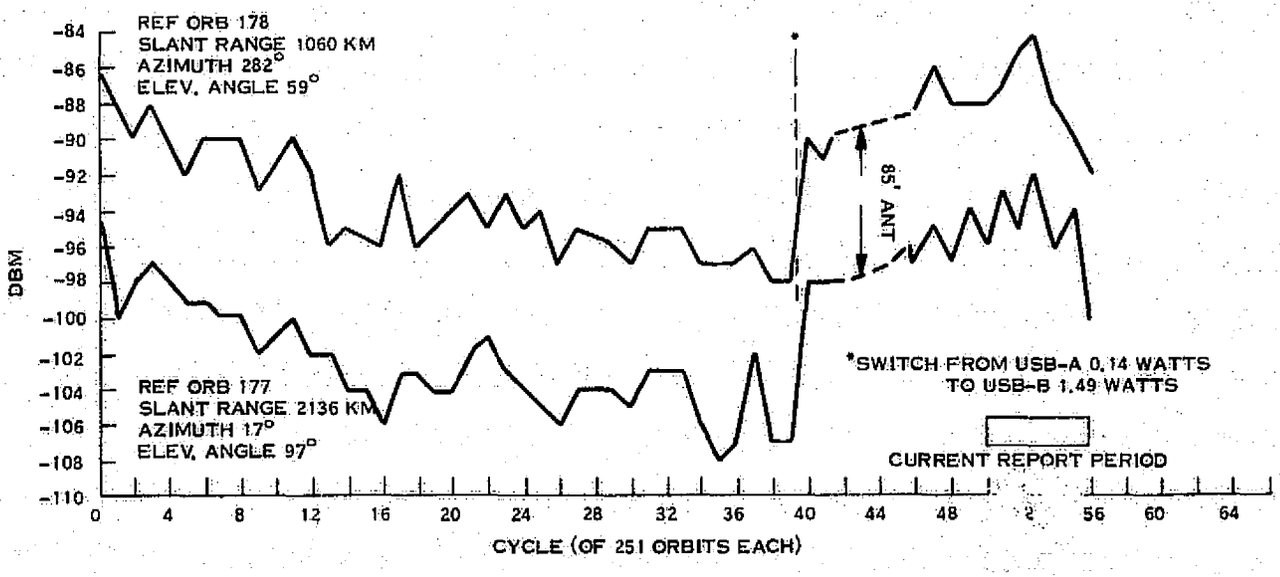

Figure 9-2. USB (Link 4) AGC Readings at Goldstone with 30-Foot Antenna

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

Auxiliary Processing Unit (APU) consists of Search Track Data, Time Code Data, and Back-up Timers which operated satisfactorily throughout this report period. Telemetry for the APU is shown in Table 10-1. The APU is in Normal mode.

Table 10-1. LANDSAT-1 APU Telemetry Functions

			Orbit							
Functions	Description	Unit	7	2600	5098	7650	10182	13198	13569	14001
13200	APU, -24.5 VDC	VDC	-24.90	-24.90	-24.90	-24.91	-24.91	-24.90	-24.91	-24.90
13201	APU, -12 Volts	VDC	-12.08	-12.08	-12.08	-12.07	-12.07	-12.06	-12.06	-12.06
13202	APU Temp.	DGC	25.49	28.50	26.95	29.21	27.15	29.99	28.24	27.45

The Power Switching Module (PSM) contains the switching relays for power to Orbit Adjust, MSS, WBVTR No. 1 and No. 2, RBV and PRM. The MSS power circuits have been operated on a regular basis throughout this report period. The power relay for the RBV remained in a failed closed condition since Orbit 196, but the RBV remained off by relays in the camera subsystem. The WBVTR No. 2 remained off due to the failure occurring in Orbit 148. The WBVTR No. 1 operation was suspended in Orbit 10861 due to high minor frame synch errors. The PRM remained on throughout this period to supply switched TLM power.

The Interface Switching Module (ISM) performed all switching normally during this report period. Compensation Loads changes were exercised in this report period as reported in Table 11-2.

SECTION 11

THERMAL SUBSYSTEM

The Thermal Subsystem of LANDSAT-1 has maintained spacecraft temperature control over a satisfactory range since launch. Table 11-1 shows average analog telemetry values from data recorded on the NBTR. During this report period, the sun angle varied as shown in Figure 3-3, and the intensity decreased as shown in Figure 3-4 for day 024 to 113. Figure 11-1 shows a typical thermal profile for average bay temperatures of the sensory ring in this report period. The values are consistent with the limits established over two years of orbital operation.

The Compensation Load History is shown in Table 11-2. Compensation load 3, turned on in Orbit 12604 to warm up the wideband electronics unit 1, was turned OFF in Orbit 13206. In the same orbit, compensation load 8 was also turned OFF, since it was located near Battery 6 which showed an unhealthy increase in temperature.

Table 11-1. LANDSAT-1 Thermal Subsystem Analog Telemetry (average Value of Frames for Data Received in NBTR Playback)

Function			Orbits					
Function No.	Description	Unit	26	5098	10182	13198	13569	14001
7001	THM TH01 STI	DGC	19.52	20.85	21.65	22.0	20.80	20.59
7002	THM TH02 SBO	DGC	18.69	19.95	20.60	19.51	19.52	19.91
7003	THM TH03 STI	DGC	18.46	20.16	20.87	19.68	19.70	19.92
7004	THM TH10 TCB	DGC	19.47	20.25	20.36	21.68	20.41	20.11
7005	THM TH04 STI	DGC	18.39	19.71	20.35	19.00	19.38	19.67
7006	THM TH05 SBO	DGC	17.57	18.39	18.81	17.61	17.71	18.13
7007	OA -X THRUSTER	DGC	21.95	22.85	22.90	22.44	21.52	22.20
7008	THM TH06-STO	DGC	15.85	16.61	16.60	15.90	15.60	16.05
7009	THM TH06 SBI	DGC	19.38	20.25	20.93	19.87	19.25	19.77
7010	THM TH07 STI	DGC	16.61	*	*	*	*	*
7011	THM TH08 STO	DGC	21.78	22.77	22.88	22.32	21.60	22.25
7012	THM TH09 SBI	DGC	21.81	22.87	23.05	23.20	22.19	22.42
7013	THM TH10 SBO	DGC	18.73	19.53	19.84	19.09	19.08	19.22
7014	THM TH11 STI	DGC	22.37	23.35	23.57	25.38	23.78	23.37
7015	THM TH12 SBO	DGC	22.37	23.17	23.03	20.82	24.08	23.62
7016	THM TH13 STI	DGC	20.95	22.02	22.47	26.74	24.50	22.80
7017	RBV BEAM CTR LN	DGC	21.53	22.62	22.64	23.74	23.35	22.21
7018	THM TH14 STO	DGC	20.38	21.40	21.93	27.76	25.16	22.67
7019	NBR RAD OUTBD B4	DGC	5.09	5.80	6.80	5.47	4.28	4.68
7020	THM TH15 SBI	DGC	21.14	22.24	23.99	28.30	25.59	23.47
7021	THM TH16 STI	DGC	20.73	22.90	23.68	26.79	24.46	23.04
7022	THM TH17 SBI	DGC	20.22	22.76	23.58	25.72	23.92	22.80
7023	THM TH18 SBO	DGC	21.90	24.29	25.19	26.49	25.24	24.53
7030	THM TH03 BUR	DGC	16.05	17.07	17.42	15.91	16.57	16.80
7031	THM TH06 BUR	DGC	13.59	14.17	14.28	13.32	13.05	13.50
7032	THM TH09 BUR	DGC	19.92	20.75	20.74	20.73	19.92	20.27
7033	THM TH12 BUR	DGC	21.51	22.16	22.76	27.03	25.08	23.74
7034	THM TH15 BUR	DGC	19.10	21.07	22.38	28.84	24.68	22.56
7035	THM TH18 BUR	DGC	20.11	21.30	22.02	23.09	21.91	21.44
7040	THM TH01 TCB	DGC	19.27	20.16	21.26	21.11	20.66	20.42
7041	THM TH02 TCB	DGC	17.99	19.23	19.89	18.87	18.71	19.01
7042	THM TH03 TCB	DGC	18.31	19.54	20.92	18.53	20.28	20.59
7043	THM TH04 TCB	DGC	18.95	19.84	20.26	19.11	19.44	19.80
7044	THM TH05 TCB	DGC	16.27	16.98	17.32	16.38	16.19	16.63
7045	THM TH07 TCB	DGC	18.41	19.31	19.45	18.80	18.22	18.64
7046	THM TH09 TCB	DGC	19.58	20.47	20.64	20.32	19.50	19.82
7048	THM TH11 TCB	DGC	21.9	22.94	23.16	25.63	24.08	23.40
7049	THM TH12 TCB	DGC	21.62	22.16	22.35	26.84	24.83	23.33
7050	THM TH13 TCB	DGC	21.21	21.99	22.28	28.06	25.45	23.09
7051	THM TH14 TCB	DGC	21.38	22.85	23.62	28.69	26.06	23.56
7052	THM TH16 TCB	DGC	21.30	23.30	25.13	27.75	26.41	24.80
7053	THM TH17 TCB	DGC	21.73	24.00	25.02	26.45	24.95	24.24
7054	THM TH18 TCB	DGC	20.42	22.20	23.35	22.96	22.20	21.92
7060	THM SHUTTER BY 1	DEG	25.85	33.12	38.62	39.63	36.01	32.99
7061	THM SHUTTER BY 2	DEG	6.62	7.65	13.25	12.13	9.09	4.09
7062	THM SHUTTER BY 3	DEG	16.96	23.78	30.24	30.77	25.75	26.61
7063	THM SHUTTER BY 4	DEG	30.69	36.71	37.92	33.09	32.58	33.92
7064	THM SHUTTER BY 5	DEG	15.03	16.25	15.00	12.54	6.48	6.42
7065	THM SHUTTER BY 7	DEG	17.14	21.14	21.96	20.93	14.07	14.05
7067	THM SHUTTER BY 9	DEG	31.26	34.11	39.50	36.45	31.97	36.22
7068	THM SHUTTER BY 10	DEG	21.68	28.03	27.31	26.25	28.61	27.74
7069	THM SHUTTER BY 11	DEG	39.66	46.89	46.96	60.10	54.11	49.97
7070	THM SHUTTER BY 12	DEG	45.41	46.63	46.68	86.26	60.65	52.80
7071	THM SHUTTER BY 13	DEG	40.39	46.76	44.79	62.67	56.99	46.30
7072	THM SHUTTER BY 14	DEG	31.20	39.10	41.91	65.41	51.21	40.90
7073	THM SHUTTER BY 15	DEG	45.40	48.71	64.79	82.16	76.31	62.76
7074	THM SHUTTER BY 16	DEG	34.50	46.46	53.54	65.76	58.34	52.47
7075	THM SHUTTER BY 17	DEG	39.06	51.99	61.88	70.41	62.45	57.50
7076	THM SHUTTER BY 18	DEG	29.78	43.15	52.20	56.62	48.94	41.17
7080	THM Q1 T ZENER V	VDC	8.19	8.19	8.19	8.19	8.19	8.19
7081	THM Q2 T ZENER V	VDC	8.40	8.40	8.40	8.40	8.40	8.40
7082	THM Q3 T ZENER V	VDC	8.31	8.31	8.32	8.31	8.32	8.32
7083	THM Q1 S ZENER V	VDC	8.31	8.42	8.35	8.35	8.33	8.32
7084	THM Q2 S ZENER V	VDC	8.19	8.19	8.20	8.22	8.20	8.19
7085	THM Q3 S ZENER V	VDC	8.15	8.17	8.15	8.16	8.15	8.15
7090	THM HSM MOUNT	DGC	21.60	22.54	22.98	24.62	22.38	22.01
7091	THM IND ATTITUDE	DGC	19.10	20.12	20.86	20.32	19.41	19.85
7092	THM RBV RADIATOR	DGC	15.85	21.22	17.47	14.66	17.26	17.19
7095	THM RBV C TR BM	DGC	20.89	21.61	21.87	23.24	21.53	21.30
7094	THM WBVTR HOOV	DGC	12.96	15.71	16.07	17.17	15.45	15.14
7095	THM WBVTR RAD CT	DGC	4.81	5.17	8.68	9.54	8.38	8.21
7096	THM WBVTR STRAP	DGC	16.62	19.72	19.66	20.56	19.01	18.72
7097	THM WB MT BAY 1	DGC	20.56	19.72	21.37	21.99	18.90	17.96
7098	THM WB MAT BAY 1	DGC	20.22	18.90	20.39	21.54	18.39	18.08
7099	THM WBVTR SEP 3	DGC	18.60	20.55	21.05	20.54	18.09	20.05
7100	THM WBVTR SEP 17	DGC	21.31	23.66	24.23	26.08	24.25	23.37
7101	THM WBVTR 1 CENT	DGC	21.49	23.72	24.01	24.86	23.31	22.97
7102	THM WBVTR 2 BAY	DGC	17.46	18.84	19.32	18.93	18.21	18.44
7103	THM WBVTR 2 BY 18	DGC	21.00	23.16	23.62	26.90	24.36	23.02
7104	THM WBVTR 2 CTR	DGC	19.35	21.51	21.81	23.37	21.70	20.74
7105	THM NBTR B SEP 6	DGC	18.06	19.30	18.79	20.01	18.07	18.35
7106	THM NBTR B SEP 1	DGC	20.62	22.35	22.69	26.69	24.19	22.60
7107	THM NBTR BM CTR	DGC	19.37	21.04	21.34	23.05	20.76	20.34
7108	THM MSS MOUNT 14	DGC	19.18	21.15	21.70	25.51	23.02	21.35
7109	THM OA -Y THRUSTER	DGC	22.21	23.60	24.69	31.40	28.41	25.52
7110	THM MSS WBVTR BM	DGC	18.14	20.06	20.53	21.49	19.20	19.15
7111	THM OA +X THRUSTER	DGC	20.30	19.92	21.22	21.94	19.23	19.13
7130	THM AUX P1 T	DGC	15.69	8.49	-18.80	14.48	11.62	1.79
7131	THM AUX P2 T	DGC	10.85	1.59	.41	20.86	12.92	4.70*

* Function 7010 became invalid after an integrated circuit chip failure in the TMP on Orbit 4396.

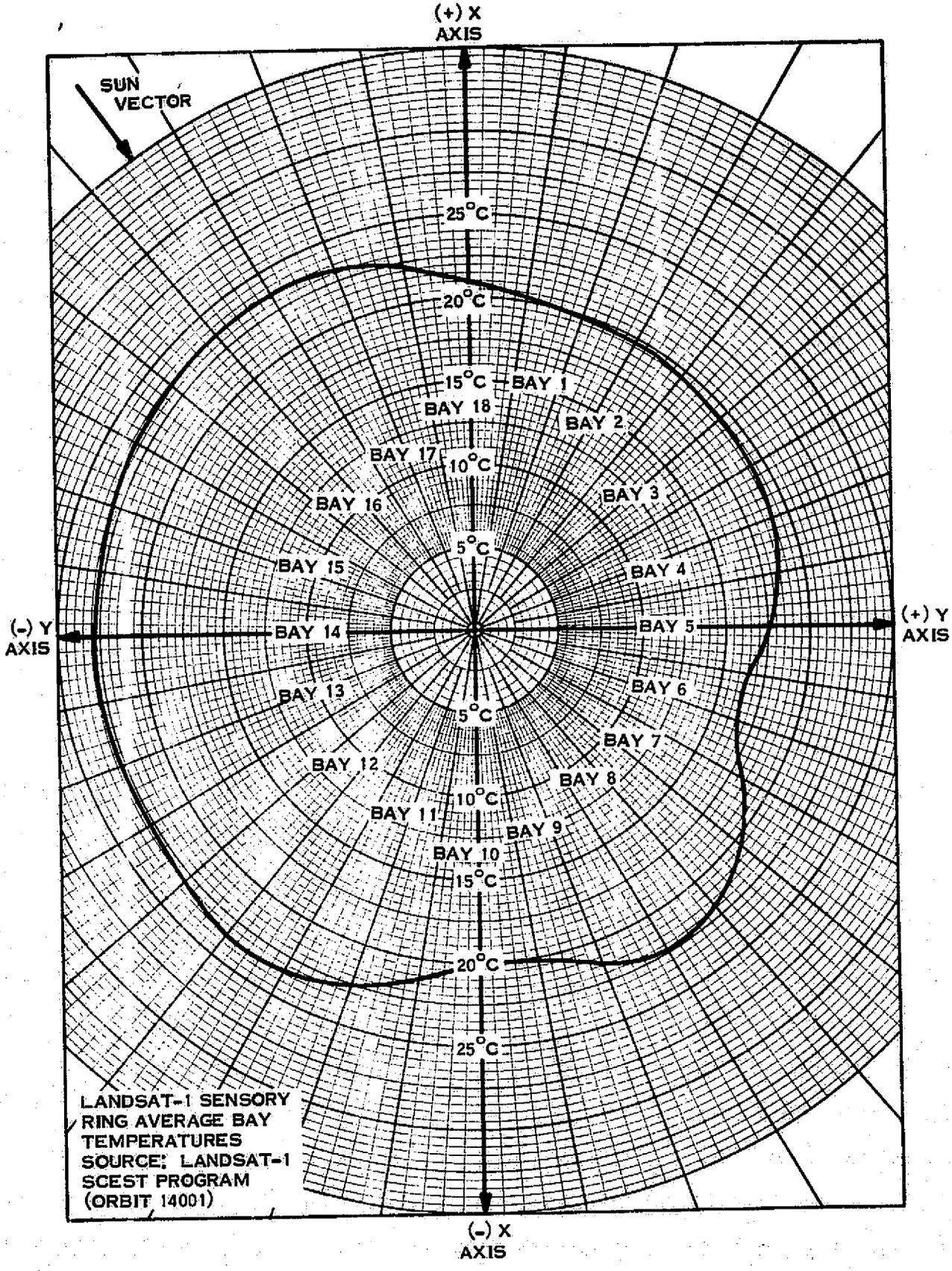

Figure 11-1. LANDSAT-1 Sensory Ring Thermal Profile

Table 11-2. LANDSAT-1 Compensation Load History

	Compensation Load Status*							
Orbits	1	2	3	4	5	6	7	8
Launch	0	0	0	0	0	0	0	0
2	0	0	x	x	x	0	x	x
6	x	x	x	x	x	0	x	x
118	0	0	0	0	0	0	0	0
156	x	x	x	x	x	0	x	x
194	0	0	0	0	0	0	0	0
197	x	x	x	x	x	0	x	x
701	x	x	0	x	x	0	x	x
1410	x	x	0	x	x	0	0	x
3484	x	x	x	x	x	0	0	x
3644	x	x	0	x	x	0	0	x
3646	x	x	x	x	x	0	0	x
4177	x	x	0	x	x	0	0	x
6872	x	x	x	x	x	0	0	x
6966	x	x	0	x	x	0	0	x
8291	x	x	x	x	x	0	0	x
8348	x	x	0	x	x	0	0	x
8449	x	x	x	x	x	0	0	x
8472	x	x	0	x	x	0	0	x
8538	x	x	x	x	x	0	0	x
8928	x	x	0	x	x	0	0	x
9898	x	x	x	x	x	0	0	x
10410	x	x	0	x	x	0	0	x
11125	0	0	0	0		0	0	0
11126	x	x	0	x		0	0	x
11127	0	0	0	0		0	0	0
11133	x	x	0	x	x	0	0	x
12604	x	x	x	x	x	0	0	x
13206	x	x	0	x	x	0	0	0

*Note: x = ON
0 = OFF

SECTION 12

NARROWBAND TAPE RECORDERS
LANDSAT-1

The Narrowband Tape Recorder Subsystem (NBR) continued to perform in a completely satisfactory manner until Orbit 13015.

From Orbit 1 through 12647, the two recorders, A and B, alternated in Record and Playback modes, switching roles nominally each orbit with a 1-minute overlap in Record for continuity.

After Orbit 12627 on 14 January 1975, the roles of the NBR's were revised to perform all telemetry recording and playback on NBR-B; and to use NBR-A to accumulate telemetry spanning MSS operations for use in processing MSS data.

Beginning in Orbit 12837 and during the week ending 8 February 1975, NBR-B exhibited noise "hits" during playback. This condition continued, and NBR-B was rested (OFF) in Orbit 13015, NBR-A assuming the total load of telemetry data Record and Playback. Real time processing was implemented to provide spacecraft attitude information needed to process MSS images, a function previously provided by NBR-A. NBR-B has remained in OFF status through the remainder of this reporting period.

To conserve the life of NBR-A, telemetry recording operation was restricted only to spacecraft health, and was limited to 7-1/2 hours (2 tapes) daily of data.

A detailed discussion of the NBR-B anomaly is given in Appendix C, PIR-U-1N23-ERTS-131. NBR operating times by modes are shown in Table 12-1.

Table 12-1. NBR Operating Hours by Modes (LANDSAT-1)

NBR	On	Off	Playback	Record
A	12173	11920	488	11685
B	11851	10540	474	11377

Table 12-2 repeats typical telemetry values since launch as shown for the previous reporting period. Due to the anomalous behavior of NBR-B and subsequent reprogramming of NBR-A support activities, telemetry values for this period are not available at the present time.

Table 12-3 is a significant sample of the data in this reporting period showing the performance parameters of the Narrowband Recorders. It includes data to evaluate the entire link, including the radio downlink transmitting data from the recorders and the effect of ground station processing. The "mean data rate," nominally 24 kilobits, reflects the motor speed. The slightly slower speed has no effect on fidelity, but only increases operating time by less than one percent. The standard deviation is a measure of effects that would cause "wow" and "flutter" in a major frame. Occasional high values are attributed to transmission link noise. The performance of NBR-A appears excellent and is as good as it has been at any time since launch.

Table 12-2. Narrowband Tape Recorder Telemetry Values

Function		Typical Telemetry Values - Orbits						
No.	Name	6	1951-1959	3750-3751	7480-7481	9865-9866	10862	12343-12344
10001	A - Motor Cur. (ma)							
	Record	190.10	189.47	189.20	186.31	186.31	186.31	186.31
	P/B	180.00	177.63	178.69	172.10	172.10	180.00	170.52
10101	B - Motor Cur. (ma)							
	Record	193.26	192.79	193.04	194.79	195.79	198.95	198.95
	P/B	188.18	189.47	185.44	186.31	189.47	187.89	189.47
10002	A - Pwr Sup. Cur. (ma)							
	Record	320.56	339.81	338.29	339.81	339.81	339.81	343.19
	P/B	535.78	563.11	568.38	569.56	569.56	567.75	569.56
10102	B - Pwr Sup. Cur. (ma)							
	Record	317.62	333.75	336.05	343.50	346.75	350.00	346.75
	P/B	570.78	567.50	555.63	574.00	567.50	567.50	567.50
10003	A - Rec. Temp. (DGC)	25.47	26.25	24.40	24.20	22.80	23.60	26.25
10103	B - Rec. Temp. (DGC)	24.58	25.38	23.41	24.54	24.77	23.41	25.38
10004	A - Supply (VDC)	-24.47	-24.50	-24.44	-24.62	-24.62	-24.62	-24.57
10104	B - Supply (VDC)	-24.44	-24.57	-24.51	-24.57	-24.29	-24.29	-24.70

Table 12-3. LANDSAT-1 Narrowband Recorder Subsystem Performance

Orbit	Bad	Missing	Mean	Std. Dev.	Rec.	Orbit	Bad	Missing	Mean	Std. Dev.	Rec.
12752	0.01	0.00	-23.84	0.02	B	13315	0.00	0.00	-23.89	0.03	A
12754	0.01	0.28	-23.84	0.40	B	13320	0.00	0.00	-23.89	0.03	A
12764	0.00	0.00	-23.86	0.02	B	13357	0.00	0.00	-23.88	N.A.	A
12771	0.00	0.00	-23.86	0.03	B	13371	0.00	0.00	-23.88	0.05	A
12778	0.00	0.00	-23.87	0.03	B						
12834	0.21	0.00	-23.85	0.47	B	13405	0.00	0.13	-23.89	0.49	A
12841	1.61	0.00	-23.86	1.46	B	13413	0.00	0.00	-23.88	0.03	A
12847	0.00	0.00	-24.08	0.01	A	13443	0.00	0.00	-23.89	0.12	A
12848	2.05	0.15	-24.08	1.95	B	13464	0.00	0.12	-23.85	0.02	A
12855	1.24	0.13	-23.86	1.40	B	13475	0.00	0.00	-23.88	0.03	A
12939	0.34	0.01	-23.85	0.67	B	13531	0.00	0.00	-23.88	0.02	A
12946	0.00	0.00	-23.87	0.02	A	13539	0.00	0.00	-23.88	0.03	A
12953	0.64	0.00	-23.85	3.08	B	13543	0.00	0.00	-23.88	0.03	A
12959	1.62	0.00	-23.85	1.31	B	13549	0.00	0.00	-23.88	0.03	A
12960	0.00	0.00	-23.86	0.02	A	13561	0.12	0.00	-23.88	0.43	A
13043	0.00	0.00	-23.88	0.02	A	13625	0.00	0.00	-23.88	0.03	A
13050	0.00	0.00	-23.88	0.03	A	13632	0.00	0.00	-23.88	0.02	A
13057	0.00	0.00	-23.88	0.02	A	13639	0.00	0.00	-23.88	0.03	A
13064	0.01	0.21	-23.87	0.55	A	13646	0.00	0.00	-23.88	0.03	A
13071	0.00	0.15	-23.88	0.46	A	13670	0.00	0.00	-23.88	0.03	A
13141	0.00	0.00	-23.85	0.02	A	13723	0.00	0.00	-23.88	0.03	A
13154	0.00	0.00	-23.88	0.02	A	13729	0.00	0.00	-23.88	0.04	A
13162	0.00	0.00	-23.89	0.03	A	13740	0.00	0.00	-23.89	0.03	A
13169	0.00	0.00	-23.88	0.02	A	13751	0.00	0.00	-23.88	0.05	A
13190	0.00	0.00	-23.88	0.02	A	13758	0.00	0.00	-23.88	0.06	A
13245	0.00	0.00	-23.88	0.02	A	13841	0.01	0.38	-23.88	0.03	A
13252	0.00	0.00	-23.88	0.02	A	13854	0.01	0.00	-23.88	0.03	A
13266	0.00	0.00	-23.88	0.06	A	13859	0.12	0.00	-23.91	0.04	A
13273	0.02	0.00	-23.89	0.03	A	13866	0.00	0.00	-23.88	0.02	A
13278	0.00	0.13	-23.88	1.48	A	13869	0.02	0.25	-23.89	0.60	A

SECTION 13

WIDE BAND TELEMETRY SUBSYSTEM

The Wide Band Telemetry Subsystem (WBTS) consists of two 10/20 watt S-Band FM Transmitters and associated filters, antennas, and signal conditioning equipment. The subsystem is used to transmit Return Beam Vidicon (RBV) video data and Multispectral Scanner (MSS) digital data to LANDSAT ground stations. The RBV and MSS data can be transmitted in real time as it is being generated, or recorded on either of two Video Tape Recorders (or both) and played back through the WBTS when in view of a ground station.

The Wide Band Telemetry Subsystem has operated successfully since turn-on in Orbit 12.

WPA No. 1 was used with RBV input until Orbit 196 when the RBV power input circuit failed. WPA-1 was used again, this time with MSS input, between Orbits 1890 and 2099 because its operating frequency was less likely to interfere with the Apollo-17 launch operations. The cumulative ON-time for WPA No. 1 is 31.9 hours. When used after Orbit 20, it operated in the 20-watt mode.

WPA No. 2 has been used with MSS input since its initial turn-ON in the 10 watt mode during Orbit 12. It was changed to the 20 watt mode in Orbit 30, and has operated at this power ever since. It was not used between Orbits 1890 and 2099. The cumulative ON time for WPA No. 2 is 1695.3 hours. Table 13-1 gives the telemetry values for both Wideband Power Amplifier units. All values are normal and show no significant trends.

Figure 13-1 shows the history of AGC levels observed at Goldstone when the spacecraft was at two selected points in space (identical azimuth, elevation and slant ranges). Variations in ground equipment performance, calibration procedures, and readout accuracy are the probable causes of saw-tooth appearance. The larger variations in AGC levels have been attributed to equipment substitutions or adjustments. Within the limits of repeatable calibration and equipment adjustment the power delivered to Goldstone appears to have been generally constant since launch. The power output of the WPA-2 as measured by telemetry (Table 13-1) has remained level since launch at about 43.5 dBm. During cycles 41 through 45 Goldstone used their 85-foot antenna instead of the normal 30-foot antenna.

Table 13-1. Wideband Modulator Telemetry Values, LANDSAT-1

WBPA-1

Function			Orbits			
Number	Name		26	1894	1944	2095
12001	Tmpt TWT Coll.	(DgC)	35.7	39.20	39.90	39.90
12002	Helix Current	(Ma)	6.08	6.49	6.58	6.78
12003	TWT Cath. Curr.	(Ma)	45.89	43.54	43.48	45.01
12004	Forward Pwr	(DBM)	43.18	42.88	42.61	43.15
12005	Reflected Pwr	(DBM)	34.95	34.99	34.80	35.21
12227	Loop Str. AFC ConVolt (1)	(MHz)	-0.39	-1.29	-0.86	-0.67
12229	Mod Temp VCO	(DgC)	21.93	20.31	20.88	20.39
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.69	2.69	2.65	2.62
12234	-15 VDC Pwr Sup A	(TMV)	5.98	5.96	5.73	5.78
12235	+5 VDC Pwr Sup A	(TMV)	3.94	3.94	3.94	3.95
12238	-5 VDC Pwr Sup A	(TMV)	5.28	5.26	5.18	5.12
12240	-24 VDC Unreg Volt A	(TMV)	5.56	5.51	5.42	5.49
12242	Inv. Temp	(DgC)	20.60	23.43	24.71	24.04

WBPA-2

Function									
Number	Name		33	2595	4096	10602	12565	13569	14001
12101	Temp TWT Coll. (Max)	(DgC)	35.38	34.80	34.24	35.96	34.80	36.54	36.54
12102	Helix Current	(Ma)	7.32	7.46	7.70	7.67	7.80	7.83	7.75
12103	TWT Cath. Cur.	(Ma)	44.30	42.52	43.85	42.72	43.22	43.40	42.83
12104	Forward Pwr	(DBM)	43.57	43.35	43.57	43.47	43.48	43.48	43.39
12105	Reflected Pwr	(DBM)	31.59	32.11	32.79	32.62	32.83	32.86	32.66
12228	Loop Str AFC Con Volt (1)	(MHz)	1.11	-1.01	-0.78	-1.12	-1.19	-1.17	-1.13
12229	Mod Temp VCO	(DgC)	21.70	24.04	20.88	21.50	20.76	22.24	22.38
12232	+15 VDC Pwr Sup A (2)	(TMV)	2.68	2.58	2.69	2.69	2.65	2.67	2.67
12234	-15 VDC Pwr Sup A	(TMV)	5.90	5.71	5.98	5.92	5.85	5.89	5.84
12236	+5 VDC Pwr Sup A	(TMV)	3.97	3.91	4.01	4.01	3.85	4.00	3.96
12239	-5 VDC Pwr Sup A	(TMV)	5.24	5.05	telemetry point defective				
12240	-24.5 VDC Unreg Volt A	(TMV)	5.43	5.33	5.52	5.46	5.47	5.43	5.45
12242	Inv. Temp	(DgC)	23.03	22.95	22.96	23.86	23.41	22.95	22.97

(1) Satisfactory if not zero or -7.5 (2) B Power Supply not yet used in orbit

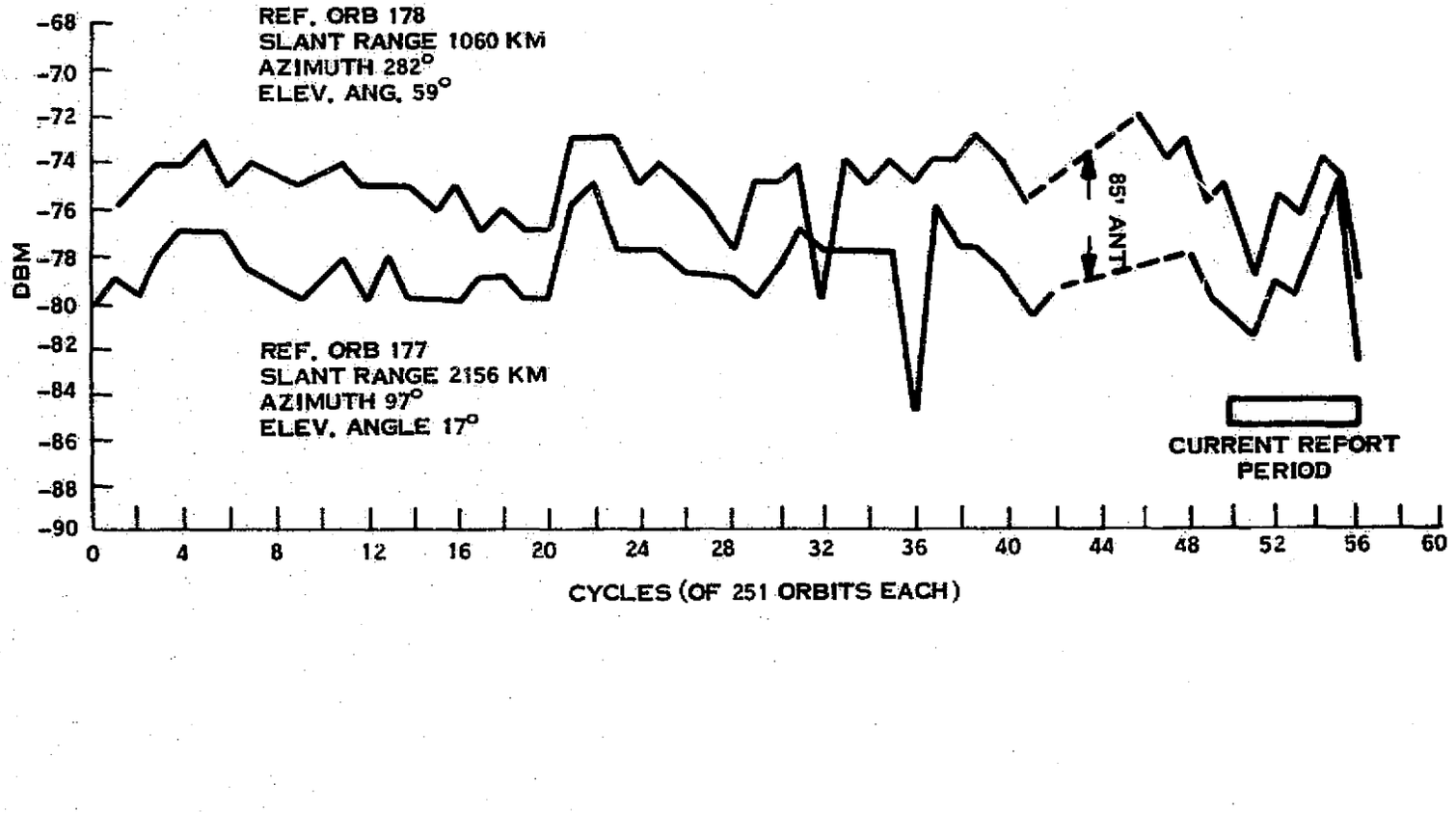

Figure 13-1. LANDSAT-1 AGC Readings at Goldstone with 30-Foot Antenna Wide Band Pwr Amp-2 (Link 3)

SECTION 14

ATTITUDE MEASUREMENT SENSOR

Telemetry output of the AMS continues to be normal and in good agreement with the ACS subsystem.

Table 14-1 gives typical AMS telemetry values.

Table 14-1. LANDSAT-1 AMS Temperature Telemetry

Function	Description	Units	Orbits					
			35	50999	10182	13198	13569	14001
3004	Case-Temp 1	DGC	18.92	19.42	19.71	20.00	18.93	19.15
3005	Assembly-Temp 2	DGC	19.15	19.76	19.96	20.28	19.16	19.39

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

The Wideband Video Tape Recorder Subsystem consists of two components - WBVTR-1 and WBVTR-2. WBVTR-2 failed in Orbit 148 after 9 hours, 26 minutes and 33 seconds of satisfactory flight performance.

WBVTR-1 operated with RBV through Orbit 196, after which it was re-configured to operate with MSS. The WBVTR-1 has had 4 major disruptions in its service, generally characterized by high headwheel current (above 0.70 amperes) and high Minor Frame Sync Error counts (above 300). These disruptions occurred during:

Orbit 3469 on 29 March 1973

Orbit 8253 on 7 March 1974

Orbit 8845 on 19 April 1974

Orbit 9881 on 2 July 1974

After Orbit 9881, the tape recorder was temporarily removed from operational service for engineering tests. These tests were suspended after Orbit 10861 on 10 September 1974. The recorders were not used during this period.

The usage of the tape by footage is shown in Figure 15-1.

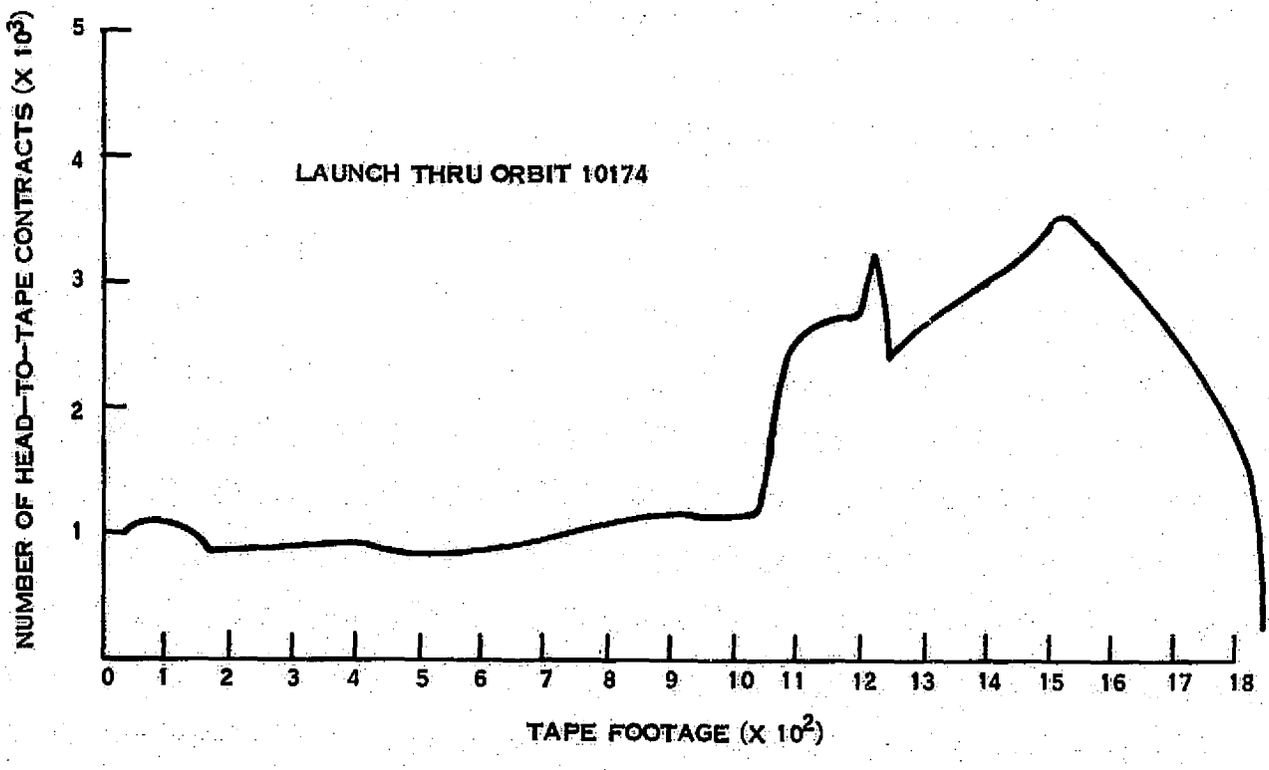

Figure 15-1. WBVTR-1 Tape Usage by Footage (LANDSAT-1)

Telemetry values for all functions are shown in Table 15-1. Although the WBVTR's were not used during this period, the last telemetry values are included for completeness. Some of the telemetered functions have different values for different operating modes: Playback, Standby, Rewind and Record. These are shown in Table 15-2, showing stable operations through Orbit 9881 except for the four occurrences of anomalies listed above.

Table 15-1. WBVTR Telemetry Values (LANDSAT-1)

WBVTR-1 Functions			Telemetry Value in Orbits						
Number	Name		15	2599	5029	10088	10602	10729	10862
13022	Pressure Trans	(PSI)	16.12	16.38	16.11	15.98	15.97	15.97	15.96
13023	Temp Trans	(DgC)	19.50	25.05	21.84	20.81	20.64	20.39	20.09
13024	Temp Elec	(DgC)	22.78	25.34	20.44	23.72	16.85	16.84	16.34
13026	Capstan Speed	(%)	100.51	98.25	101.93	102.84	88.24	101.39	90.16
13027	Headwheel Speed	(%)	95.16	96.84	95.17	93.47	85.04	90.26	90.81
13028	Capstan Mot I	(Amp)	0.25	0.26	0.27	0.28	0.20	0.22	0.24
13029	Input P/B Volt.	(VPP)	0.72	0.41	0.45	0.33	0.54	0.38	0.56
13030	Headwheel Mot I	(Amp)	0.55	0.55	0.54	0.55	0.61	0.54	0.53
13031	Rec Input I	(Amp)	3.15	3.31	3.68	2.82	2.64	2.73	2.79
13032	Lim Volt Out	(VPP)	1.44	1.42	1.45	1.17	1.32	1.32	1.33
13033	Servo Volt	(%)	50.03	50.23	50.74	47.71	49.97	49.96	48.98
13034	+5.6 VDC Conv	(VDC)	5.66	5.71	5.68	5.65	5.86	5.84	5.78

WBVTR-2 Functions			Orbit Number			
Number	Name		15	64	103	147
13122	Pressure, Trans	(PSI)	15.99	16.25	16.25	16.11
13123	Temp Trans	(DgC)	18.46	19.19	20.72	21.09
13124	Temp Elec	(DgC)	21.50	22.00	24.00	21.92
13126	Capstan Speed	(%)	99.91	100.53	100.80	99.38
13127	Headwheel Speed	(%)	94.16	95.48	97.64	98.78
13128	Capstan Mot I	(Amp)	0.17	0.24	0.24	0.28
13129	Input P/B Volt	(VPP)	0.66	0.63	0.62	0.61
13130	Headwheel Mot I	(Amp)	0.55	0.59	0.52	0.53
13131	Rec Input I	(Amp)	3.70	3.53	3.07	3.43
13132	Lim Volt Out	(VPP)	1.34	1.41	1.41	1.39
13133	Servo Volt	(%)	49.97	49.60	49.80	49.48
13134	+5.6 VDC	(VDC)	5.47	5.64	5.58	5.59

Table 15-2. WBVTR-1 Function Values by Mode in Orbit (LANDSAT-1)

Function/Description	Orbits							
	913	2379	3781	4876	7385	7953	9866	10862
13029 - Input P/B Voltage								
Record	0	0	0	0	0	0	0	0
Playback	0.40	0.45	0.58	0.53	0.48	0.48	0.67	0.69
Rewind	0	0	0	0	0	0	0	0
Standby	0	0	0	0	0	0	0	0
13028 - Capstan Motor Current								
Record	0.23	0.24	0.26	0.23	0.26	0.25	0.25	0.28
Playback	0.25	0.25	0.26	0.26	0.28	0.23	0.28	0.26
Rewind	0.23	0.20	0.20	0.17	0.17	0.18	0.18	0.20
Standby	0	0	0	0	0	0	0	0
13030 - Headwheel Motor Current								
Record	0.58	0.55	0.58	0.58	0.58	0.58	0.60	0.57
Playback	0.56	0.55	0.62	0.56	0.55	0.58	0.59	0.54
Rewind	0.47	0.44	0.46	0.45	0.43	0.45	0.46	0.43
Standby	0.47	0.44	0.44	0.44	0.44	0.44	0.44	0.44
13031 - Recorder Input Current								
Record	3.70	3.63	3.46	3.40	3.40	3.30	3.30	3.20
Playback	3.85	3.89	3.74	3.76	3.69	3.56	3.59	3.56
Rewind	2.20	2.18	2.07	1.89	1.94	1.85	1.85	1.85
Standby	1.96	2.08	1.78	1.73	1.88	1.98	1.85	1.85
13033 - Servo Voltage								
Record	0	0	0	0	0	0	0	0
Playback	50.30	50.37	50.70	50.78	50.76	50.96	50.86	51.05
Rewind	0	0	0	0	0	0	0	0
Standby	0	0	0	0	0	0	0	0
13026 - Capstan Motor Speed								
Record	98.50	96.70	102.88	103.41	103.41	105.09	104.53	106.49
Playback	98.40	97.20	101.3	102.40	101.16	104.[illegible]	103.41	103.96
Rewind	101.70	101.1	99.20	98.90	99.48	9[illegible]	98.36	98.36
Standby	0	0	0	0	0	0	0	0
13027 - Headwheel Motor Speed								
Record	97.10	100.0	94.23	93.64	93.06	91.88	91.88	90.70
Playback	97.10	97.80	93.69	92.93	93.06	90.70	91.29	90.70
Rewind	100.72	100.70	95.10	93.60	93.64	91.88	91.88	41.88
Standby	100.70	102.80	95.41	96.00	95.41	90.12	93.65	93.06

SECTION 16

RETURN BEAM VIDICON

The Return Beam Vidicon (RBV) Subsystem operated normally from turn-on in Orbit 19 to Orbit 196 when it failed to respond to a turn-off command because of a probable failure of a relay in the Power Switching Module. The RBV itself was not the cause of the failure, nor was it affected by the failure. The RBV has not been reactivated since Orbit 196, but it is capable of operation through individual component power switching. An assessment of the RBV performance was given in ERTS-1 Flight Evaluation Report 23 July to 23 October 1972. For completeness and convenience, the telemetry values are repeated in Table 16-1.

Table 16-1. RBV Telemetry Values (LANDSAT-1)

Function			Orbits			
No.	Name	T/V Value	26	85	149	196
14001	CCC Board Temp. (DgC)	(1)	18.61	20.04	19.30	19.53
14002	CCC Pwr. Sup. Temp. (DgC)	(1)	19.93	21.58	20.70	21.21
14003	± 15 VDC Sup. (TMV)	3.95	3.69	3.95	3.78	3.95
14004	± 6V-5.25 VDC Sup. (TMV)	3.05	2.84	2.93	2.98	3.05
14100	VID OUT CAM 1 (TMV)	1.06	1.04	1.15	1.13	1.12
14200	VID OUT CAM 2 (TMV)	1.09	1.05	1.26	1.23	1.24
14300	VID OUT CAM 3 (TMV)	1.05	1.03	1.21	1.19	1.20
14102	Comb. Align I Com 1 (TMV)	3.95	3.67	3.94	3.87	3.94
14202	Comb. Align I Com 2 (TMV)	3.92	3.90	3.91	3.89	3.91
14302	Comb. Align I Com 3 (TMV)	4.04	3.75	4.03	3.80	4.03
14103	Cam 1 Elec Temp. (DgC)	(1)	20.84	23.37	22.64	25.38
14203	Cam 2 Elec Temp. (DgC)	(1)	18.64	21.06	20.62	22.87
14303	Cam 3 Elec Temp. (DgC)	(1)	21.05	23.61	23.23	25.57
14104	Cam 1 LV Pwr Sup T. (DgC)	(1)	21.71	23.94	23.49	25.92
14204	Cam 2 LV Pwr Sup T. (DgC)	(1)	18.38	20.63	19.40	23.30
14304	Cam 3 LV Pwr Sup T. (DgC)	(1)	20.75	23.02	22.73	25.67
14105	Cam 1 Def. + 10 VDC (TMV)	4.01	3.73	4.00	3.77	4.00
14205	Cam 2 Def. + 10 VDC (TMV)	4.00	3.71	3.98	3.77	3.98
14305	Cam 3 Def. + 10 VDC (TMV)	3.97	3.95	3.95	4.02	3.95
14106	Cam 1 + 6V -6.3 VDC (TMV)	3.71	3.45	3.70	3.61	3.70
14206	Cam 2 + 6V -6.3 VDC (TMV)	3.69	3.42	3.67	3.49	3.67
14306	Cam 3 + 6V -6.3 VDC (TMV)	3.73	3.47	3.72	3.47	3.72
14107	Cam 1 Telec I (TMV)	2.62	2.50	2.54	2.55	2.64
14207	Cam 2 Telec I (TMV)	2.65	2.53	2.56	2.41	2.64
14307	Cam 3 Telec I (TMV)	2.64	2.54	2.51	2.45	2.61
14108	Cam 1 Vid Fil I (TMV)	2.47	2.30	2.36	2.38	2.46
14208	Cam 2 Vid Fil I (TMV)	2.54	2.37	2.52	2.39	2.52
14308	Cam 3 Vid Fil I (TVM)	2.61	2.44	2.60	2.53	2.60
14110	Cam 1 TARVOLT (TMV)	3.43	3.42	3.42	3.45	3.42
14210	Cam 1 TARVOLT (TMV)	3.36	3.13	3.22	3.26	3.32
14310	Cam 3 TARVOLT (TMV)	3.47	3.23	3.46	3.45	3.47
14113	Cam 1 Vert Def V (TMV)	2.96	2.75	2.90	2.85	2.97
14213	Cam 2 Vert Def V (TMV)	3.00	2.86	2.98	2.86	3.01
14313	Vam 3 Vert Def V (TMV)	3.45	3.45	3.47	3.37	3.45
14114	Cam 1 Vid FPT (DgC)	(1)	18.15	20.77	17.91	20.99
14214	Cam 2 Vid FPT (DgC)	(1)	20.62	20.11	20.52	20.62
14314	Cam 3 Vid FPT (DgC)	(1)	18.54	20.88	19.08	20.20
14115	Cam 1 Foc Coil T (DgC)	(1)	17.71	21.67	18.74	19.70
14215	Cam 2 Foc Coil T (DgC)	(1)	17.70	21.60	19.25	19.97
14315	Cam 3 Foc Coil T (DgC)	(1)	18.03	22.09	19.88	20.56

(1) Thermo-Vacuum temperatures for these functions were not reported.

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner (MSS) system consists of spacecraft and ground equipment which permits images of the earth to be obtained simultaneously in 4 or 5 spectral bands. LANDSAT-1 and LANDSAT-2 MSS use a 4-band scanner operating in the solar reflected spectral region from 0.5 to 1.1 micrometers (microns) wave length, and scans cross-track swatches of 0.5 km width (at a 496 nm altitude), imaging six scan lines across in each of the four spectral bands simultaneously. The object plane is scanned by means of an oscillating flat mirror between the scene and the double reflector telescope optical chain. The 11.56 degree cross-track field-of-view is scanned as the mirror oscillates approximately ± 2.89 degrees 13.62 times per second about its nominal position.

The instantaneous field-of-view of each detector subtends an earth-area square of 259 feet on a side from the nominal orbit altitude. Field stops are formed for each line imaged during a scan, and for each spectral band, by the square input end of an optical fiber. Six of these fibers in each of four bands are arranged in a 4 x 6 matrix in the focal plane of the telescope.

The Multispectral Scanner Subsystem (MSS) has operated satisfactorily since initial turn-on in Orbit 20. The MSS has imaged nearly all of the land masses between the latitudes of 81.42° N/S. Many of these scenes were repeatedly imaged, some in the United States as many as 45 times. A very large percentage of every continent has been imaged. Figure 17-1 is a computer derived map showing how many scenes were imaged at each geographic location since launch. Along the right-hand edge of the map is listed the frame number - frame 1 being at the northern-most extreme, frame 61 centered on the equator, and frame 121 at the southernmost extreme, thus giving latitude. Along the top of the map is the number of the reference orbit which fixes longitude. The land masses are distorted to fit this map projection.

Figure 17-2 shows how many scenes were acquired during this reporting period.

MSS has transmitted real time images to two foreign countries; 20,192 images were transmitted to Canada, and 14,515 to Brazil.

Table 17-1 shows typical telemetry values during this quarter. All functions are normal. The maximum MUX temperature to date has been 33.25°C which occurred in August 1973, when the MSS was accidentally left ON at LOS, and was turned OFF by the 32-minute back-up timer. The calibration lamp current has remained nominally at 1.12 TMV from pre-launch to the present.

Time Code extracted from de-muxed data was found normal.

The response history of each sensor to a selected input radiance level is shown in Figure 17-3 thru 17-6. Only one radiance level for each sensor has been selected for graph presentation, but the other five levels selected in the computer program to determine the calibration wedge shape have been analyzed and found to be consistent with the data presented.

In general, the graphs show an early gradual decrease in sensor response from launch to Orbit 1000, and essentially unchanged response thereafter. The notable exception is sensor 13. The response of this sensor has gradually increased about 15%, so that it saturates at a lower radiance level than the other sensors.

The history of Line Length Word vs. Orbit Number is shown in Figure 17-7. It is satisfactory and stable.

Sun calibrations are performed every two weeks and continue to show normal performance. The 94 Sun Calibration Orbits are listed in Table 17-2.

A record of MSS operations in the High Gain and in Linear Mode is shown in Table 17-3.

Table 17-1. LANDSAT-1 MSS Telemetry Values

Function No.	Name		Telemetry Values in Orbits						
			20	2599	5060	10597	13330	13569	14001
15044	FOPT 2 T	(DGC)	17.46	21.03	19.84	19.75	19.04	19.11	18.82
15046	ELEC CVR T	(DGC)	19.37	23.53	21.83	21.96	20.14	20.28	19.99
15048	SCAN MIR REG T	(DGC)	16.35	22.84	19.77	20.48	21.05	21.17	20.44
15050	SCAN MIR DR. COIL T	(DGC)	15.94	21.97	19.30	19.78	20.51	20.57	19.77
15052	ROT SHUT HSG T	(DGC)	16.91	20.88	20.07	20.23	19.48	19.62	19.32
15043	FOPT 1 T	(DGC)	17.67	21.17	20.01	19.93	19.26	19.31	19.03
15045	MUX PWR CASE T	(DGC)	21.19	26.84	22.03	[illegible].87	26.44	25.57	24.17
15047	PWR SUP T	(DGC)	17.41	21.95	20.00	20.21	20.04	20.23	19.80
15049	SCAN MIR DR. ELC T	(DGC)	16.12	22.76	19.41	20.23	20.90	21.10	20.21
15051	SCAN MIR HSG T	(DGC)	15.60	21.46	19.05	19.49	20.11	20.07	19.40
15040	MUX-6 VDC	(TMV)	4.03	4.03	4.03	3.98	3.99	4.03	3.95
15042	AVE DENS DATA	(TMV)	1.67	2.52	2.13	2.05	2.13	2.25	2.37
15054	CAL LAMP CUR A	(TMV)	1.12	1.12	1.12	1.12	1.12	1.12	1.12
15056	BAND 2 $\pm$ 15 VDC	(TMV)	5.10	5.10	5.10	5.04	5.10	5.10	5.10
15058	BAND 4 $\pm$ 15 VDC	(TMV)	5.10	5.10	5.10	5.04	5.05	5.10	5.10
15060	+12 -6 VDC REG	(TMV)	4.82	4.92	5.02	4.97	4.93	4.99	5.02
15062	+19 VDC REG OUT	(TMV)	4.80	4.90	4.90	4.97	4.93	4.99	5.20
15064	BAND 1 HV A	(TMV)	5.10	5.12	5.16	5.12	5.12	5.13	5.12
15066	BAND 2 HV A	(TMV)	4.50	4.52	4.52	4.52	4.51	4.50	4.52
15068	BAND 3 HV A	(TMV)	4.60	4.63	4.62	4.62	4.62	4.62	4.65
15070	SHUT MOT CON OUT	(TMV)	2.43	2.46	2.44	2.47	2.46	2.49	2.46
15041	S/D CONV REF V	(TMV)	5.93	5.82	5.93	5.87	5.82	5.89	5.82
15053	SCAN MIR REG V	(TMV)	4.42	4.53	4.51	4.56	4.53	4.58	4.52
15055	BAND 1 $\pm$ 15V	(TMV)	4.97	4.97	4.97	4.92	4.98	4.97	4.97
15057	BAND 3 $\pm$ 15V	(TMV)	5.00	5.00	5.00	4.94	5.00	5.00	4.91
15059	-15 VDC TEL.	(TMV)	5.02	5.02	5.02	5.02	5.02	5.02	5.02
15061	$\pm$ 5 VDC LOGIC REG	(TMV)	4.82	4.80	4.81	4.77	4.79	4.76	4.78
15063	-19 VDC REG OUT	(TMV)	3.43	3.50	3.39	3.50	3.51	3.52	3.51
15071	SCAN MIR DR. CLK	(TMV)	1.93	1.97	1.97	1.98	1.97	1.99	1.96

FOLDOUT FRAME /

ORIGINAL PAGE IS
OF POOR QUALITY

Figure 17-1. Number of Scenes Taken for U.S. at Each Geographical Location, LANDSAT-1

DATA USED FROM CYCLE
THE FOLLOWING MAP SHOWS

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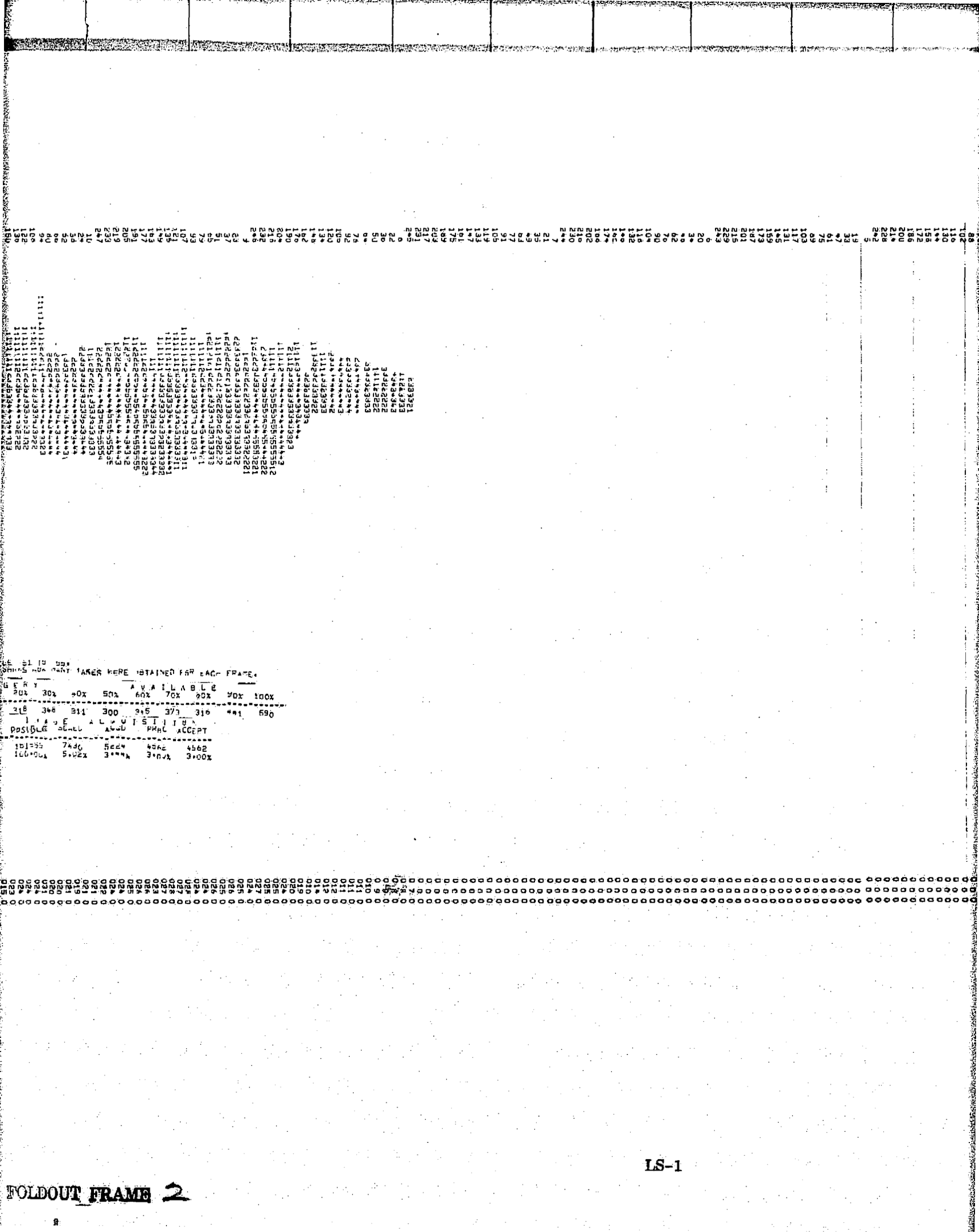
OF POOR QUALITY



TAKES WERE OBTAINED FOR EACH FRAME.

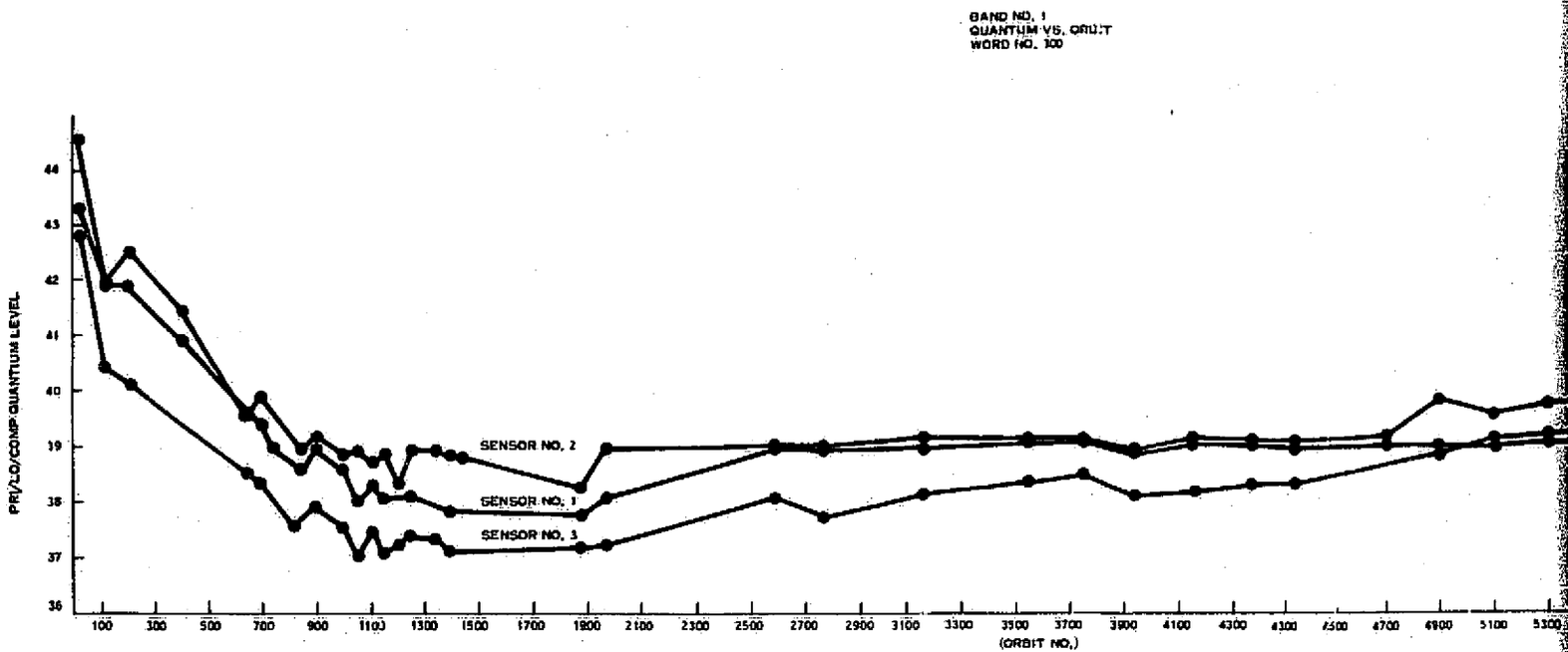
AVAILABLE								
20%	30%	40%	50%	60%	70%	80%	90%	100%
218	346	311	300	345	373	316	**81	690

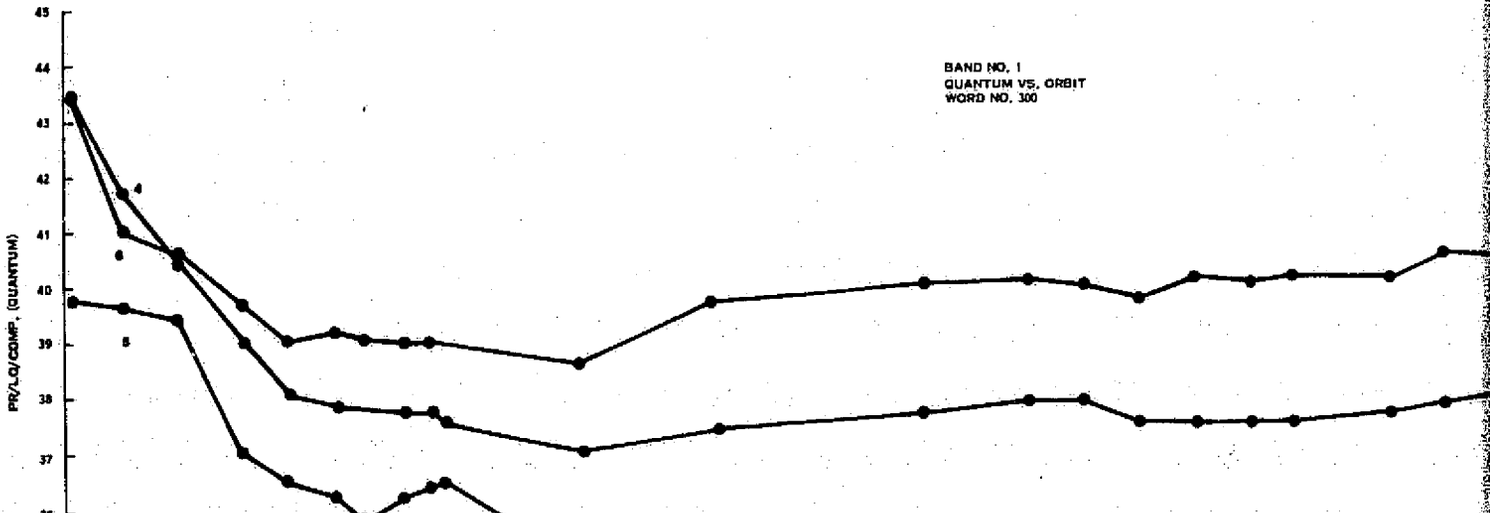
POSSIBLE	SELECTED	AVAILABLE	REJECT	ACCEPT
10[**95	7480	5224	4582	4582
100*00%	5.02%	3***%	3*00%	3*00%

LS-1

FOLDOUT FRAME 2

Figure 17-2. Scenes Taken This Reporting Period, LANDSAT-1





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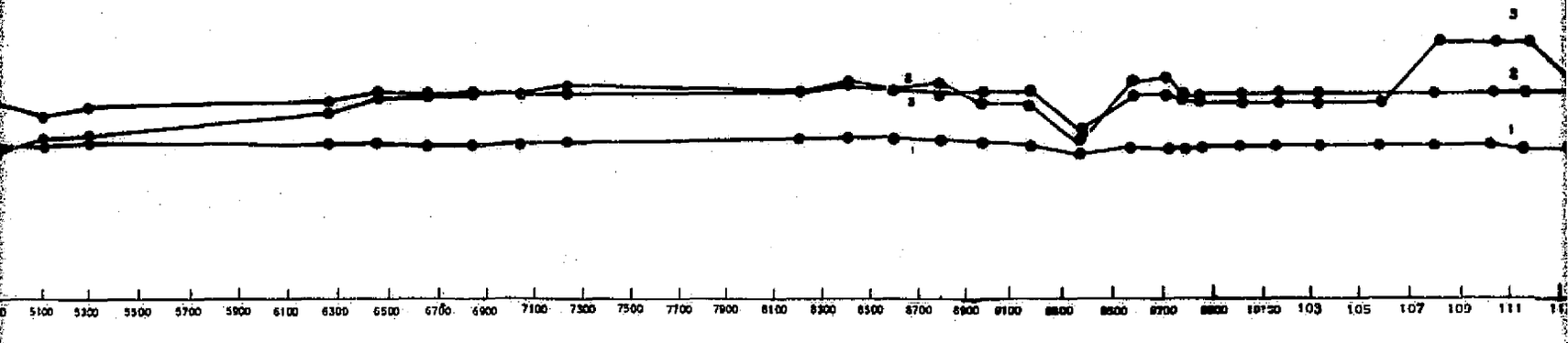

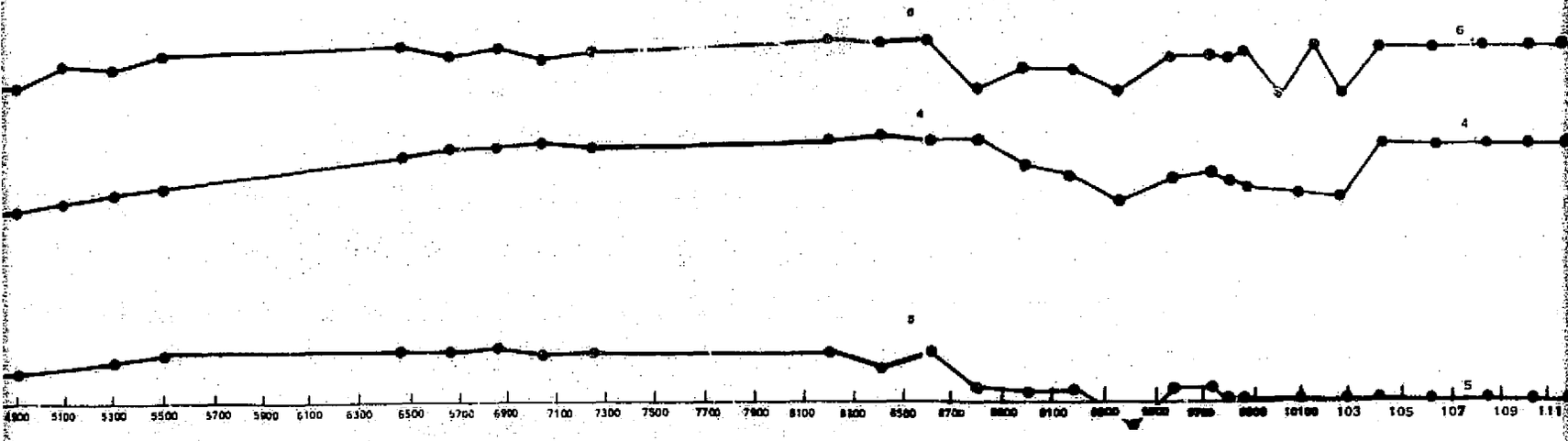

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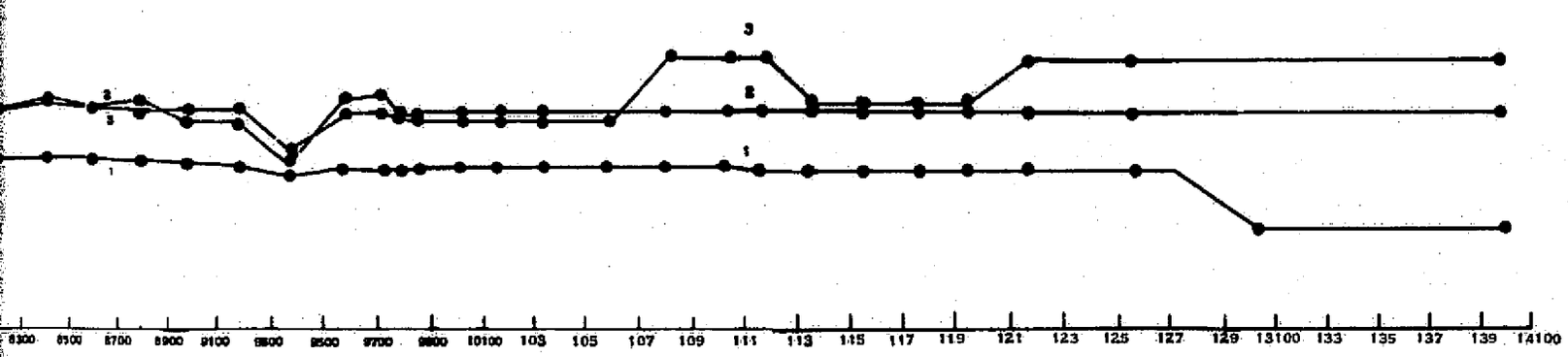
LS-1



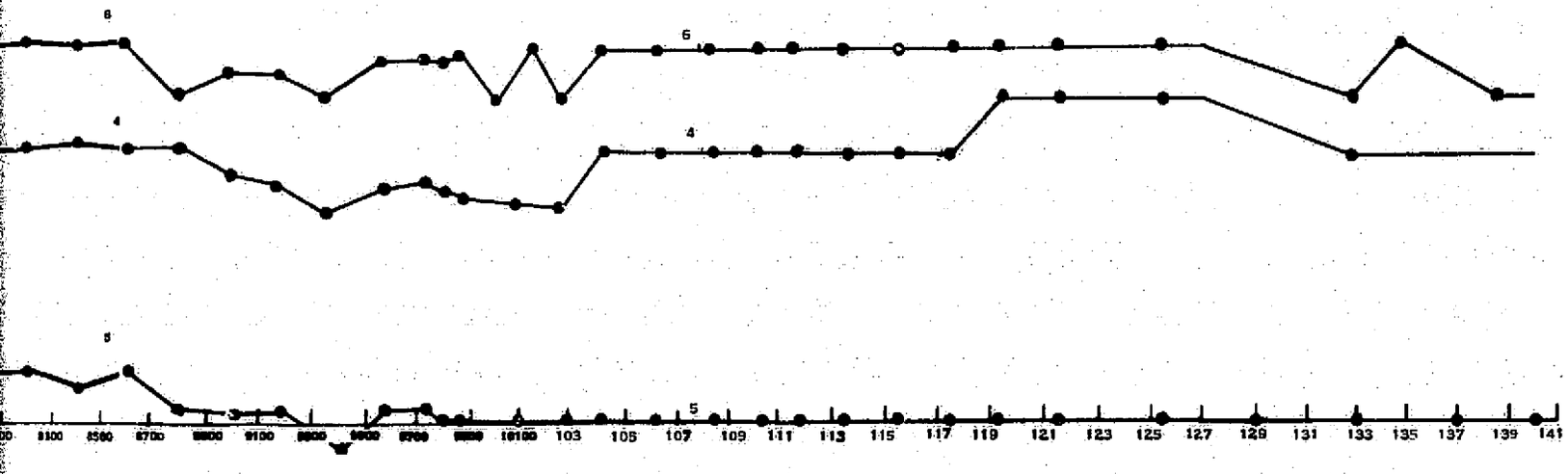
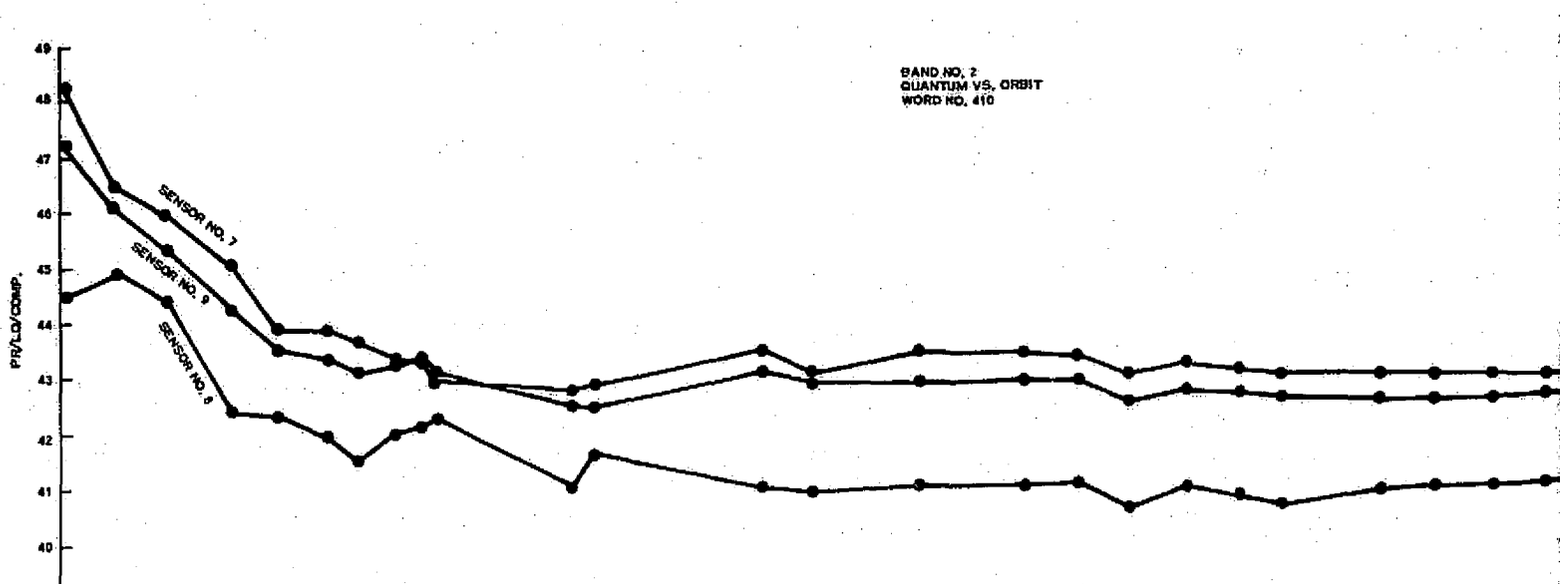
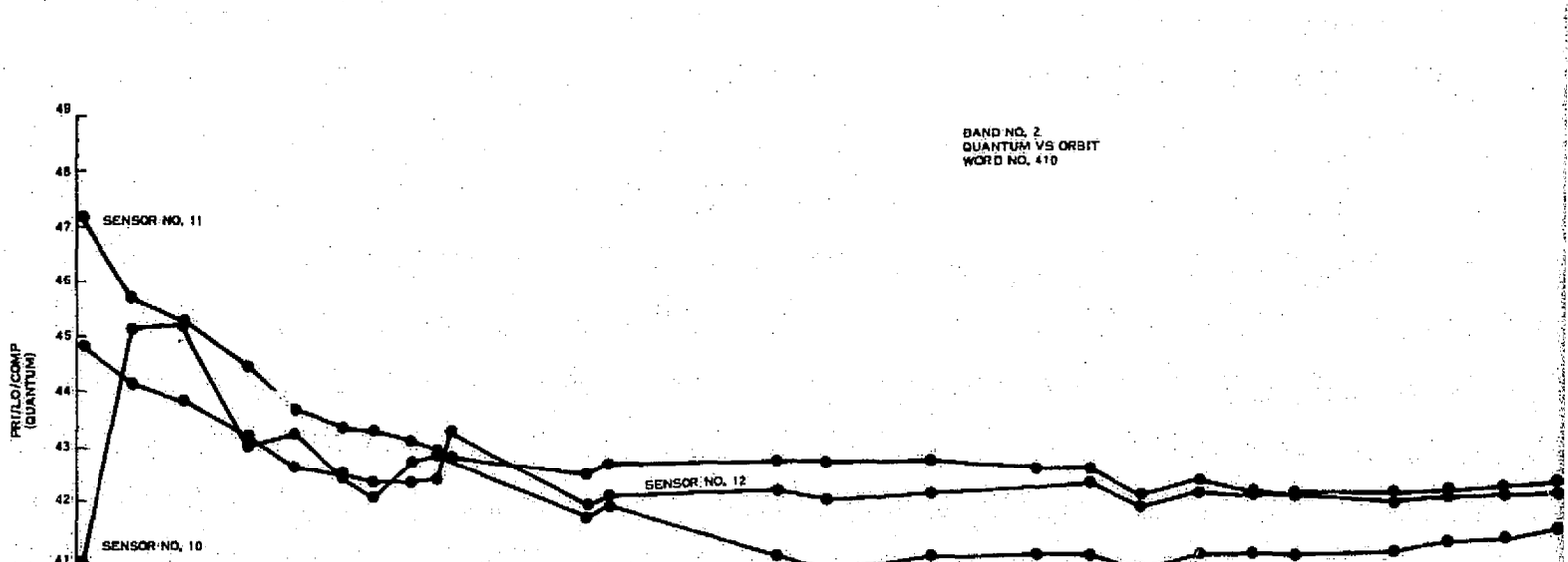


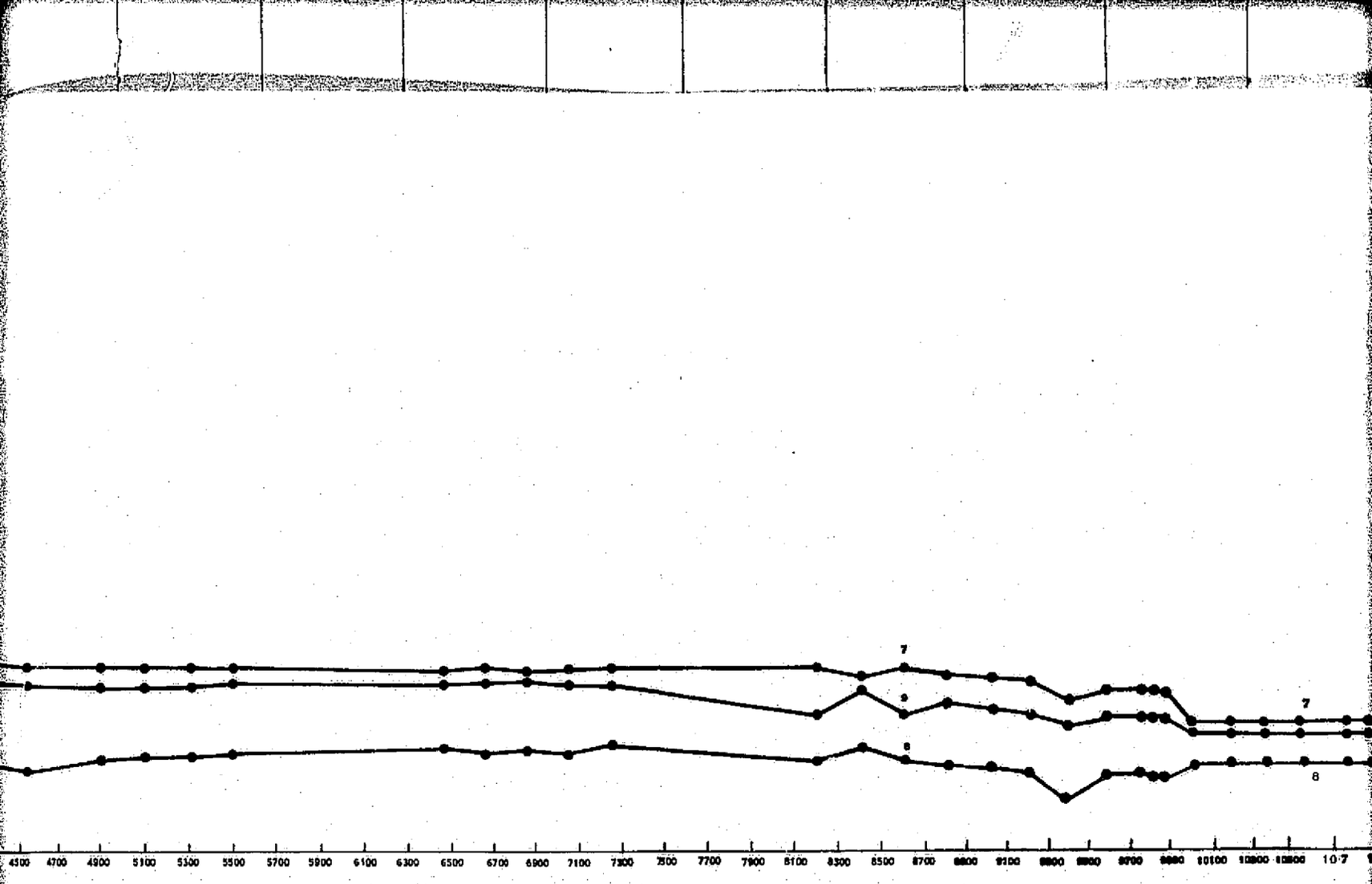
Figure 17-3. Quantum vs Orbit
(LANDSAT-1)

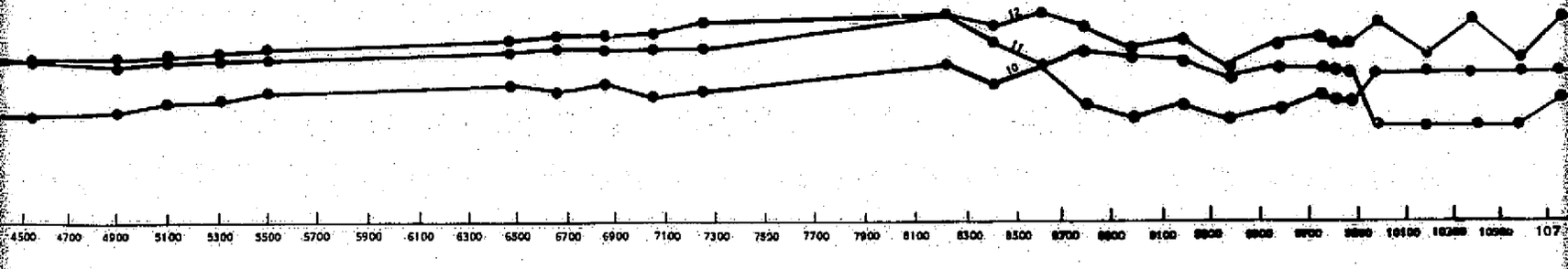
FOLDOUT FRAME 3

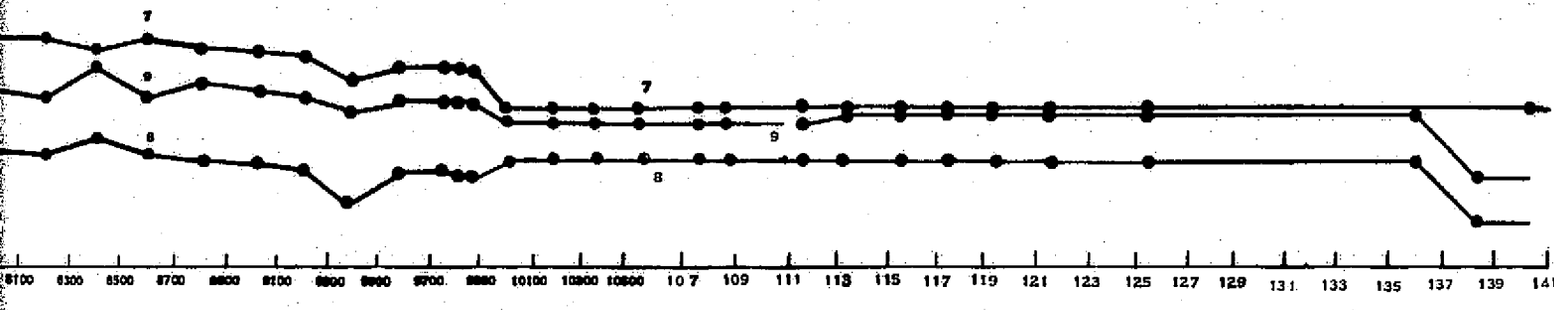




FOLDOUT FRAME







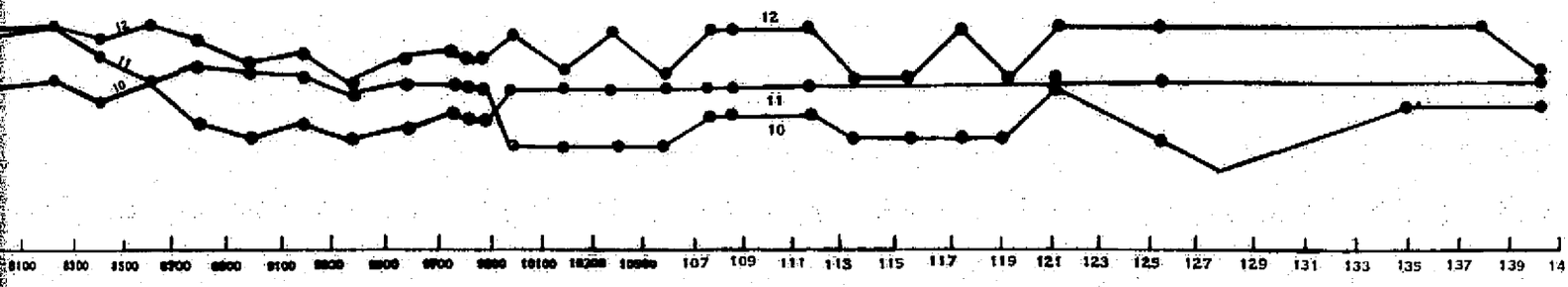
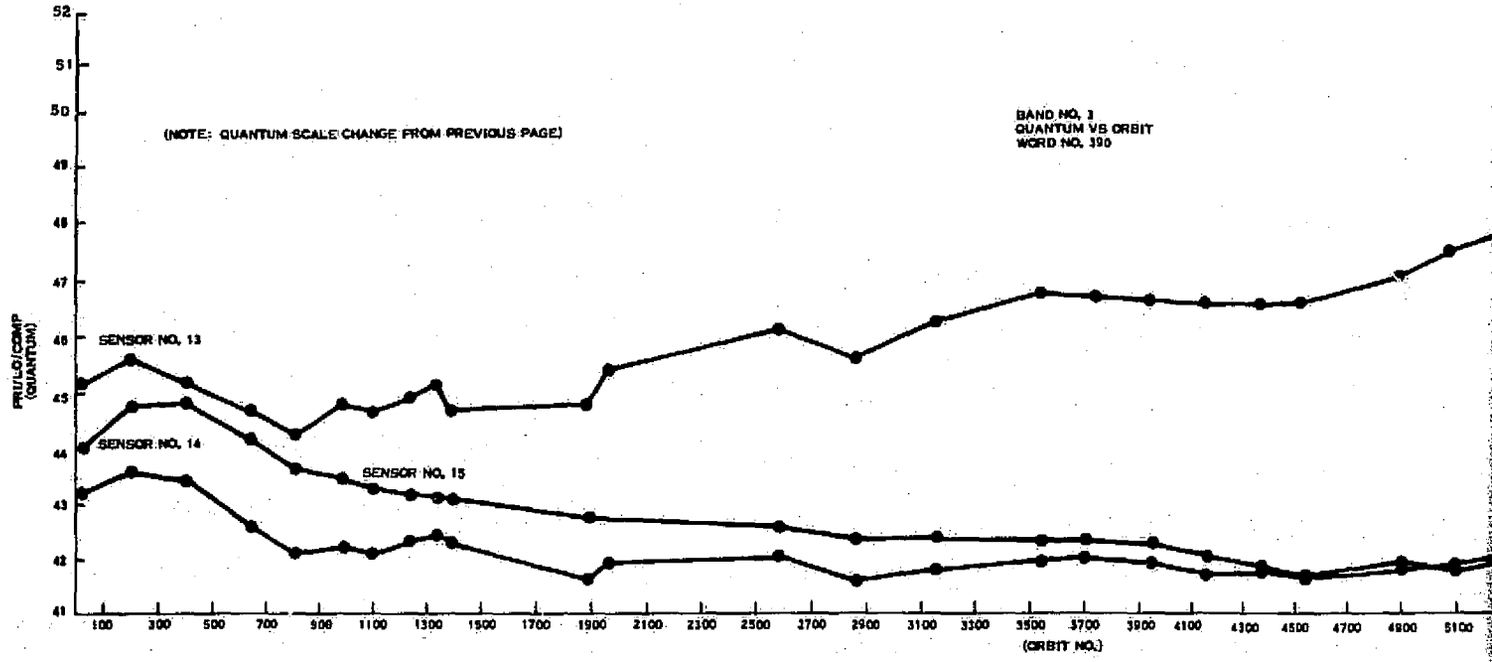
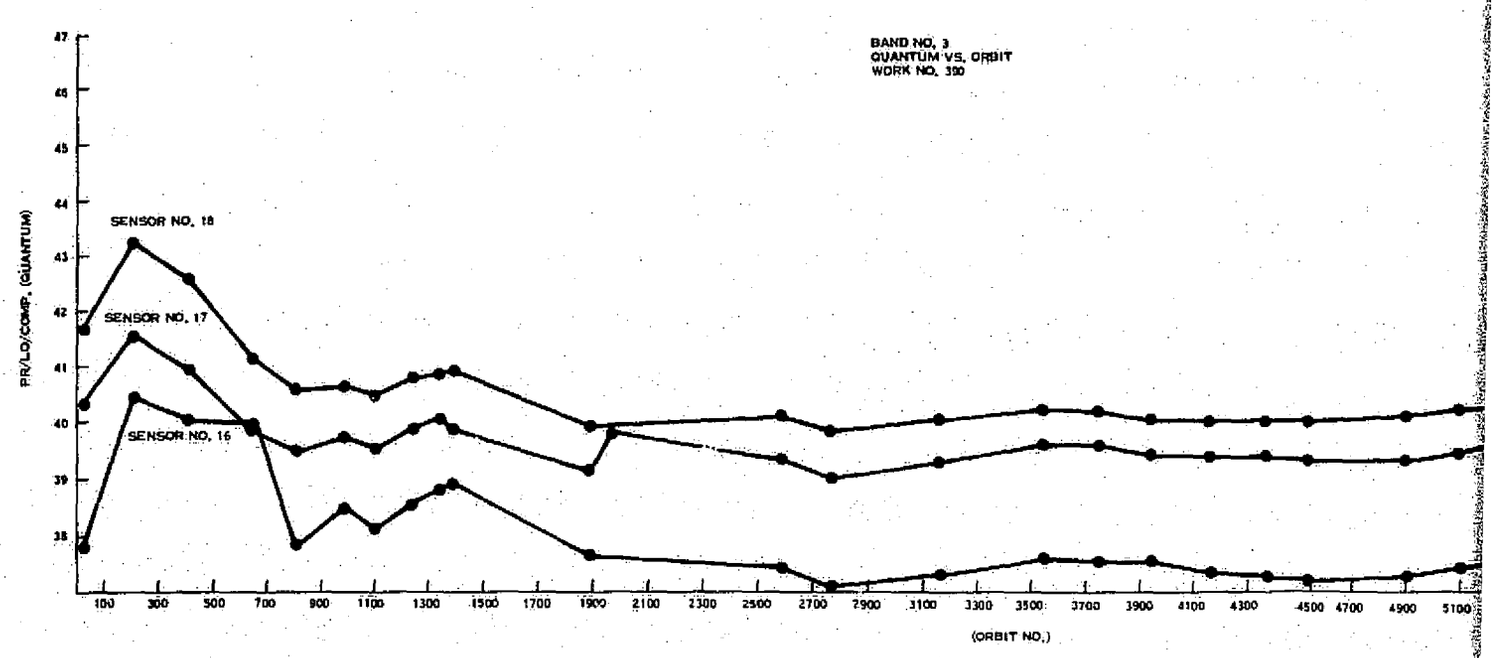
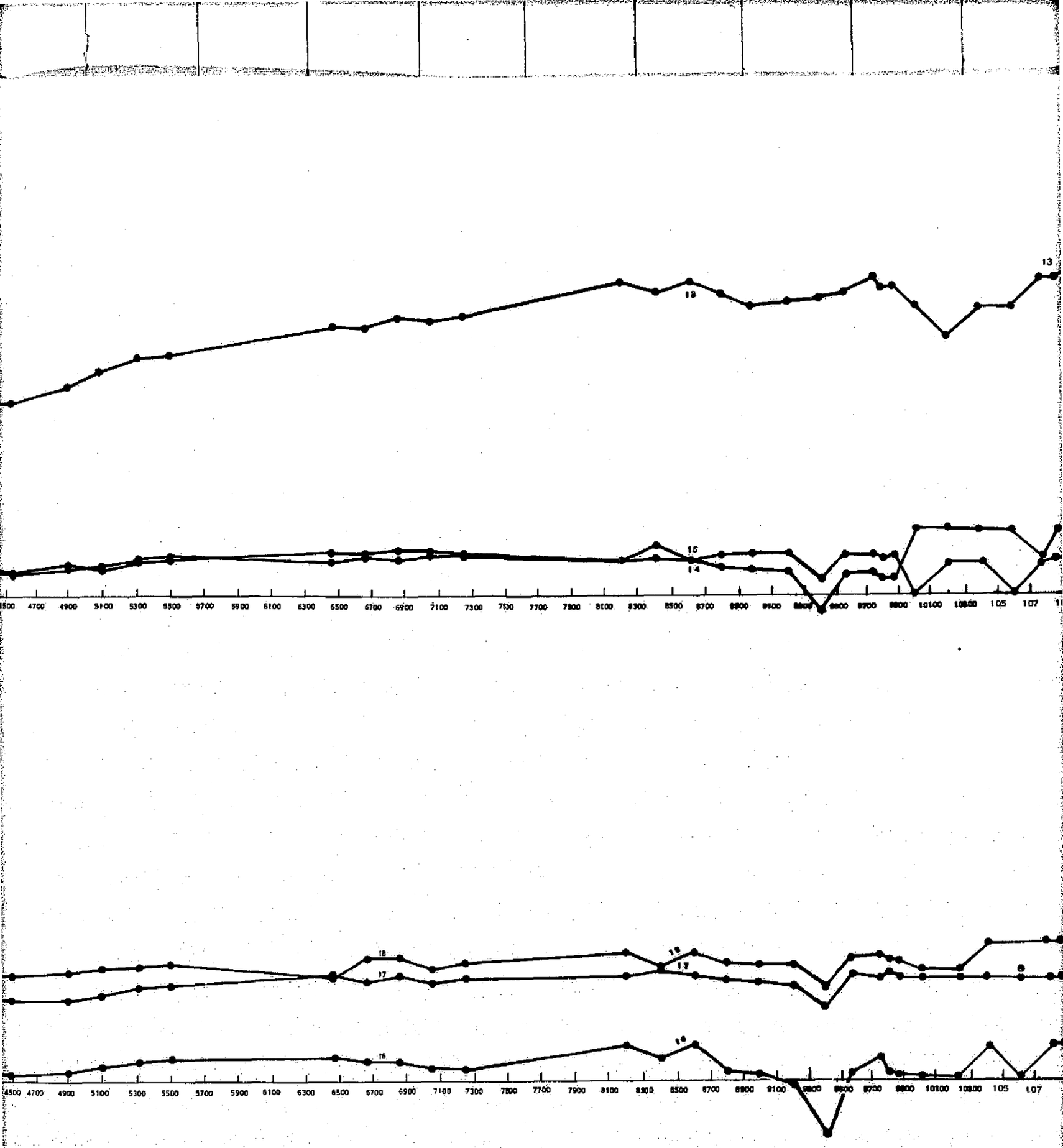


Figure 17-4. Quantum vs Orbit
(LANDSAT-1)





FOLDOUT FRAME 1



FOLDOUT FRAME 2

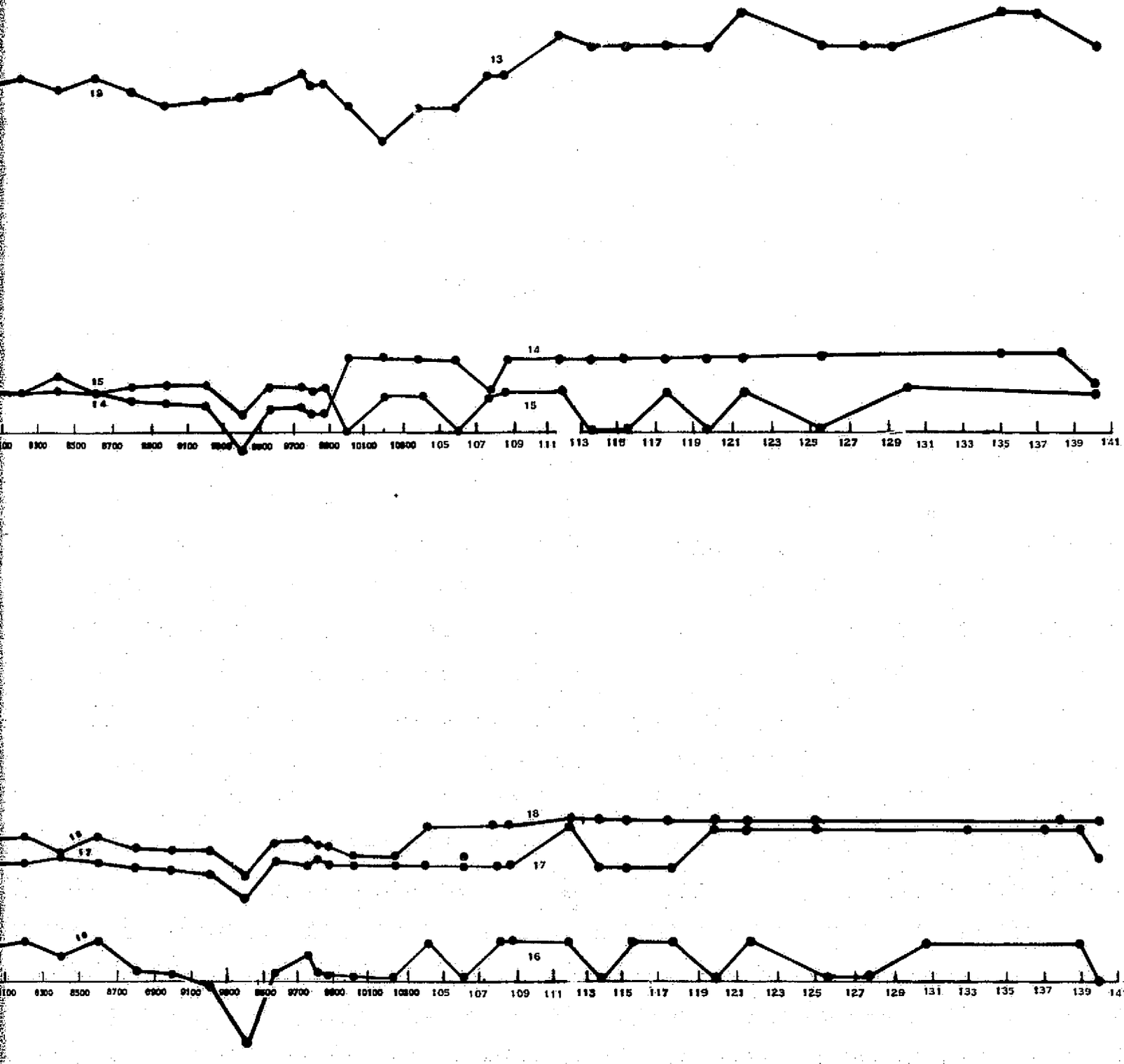
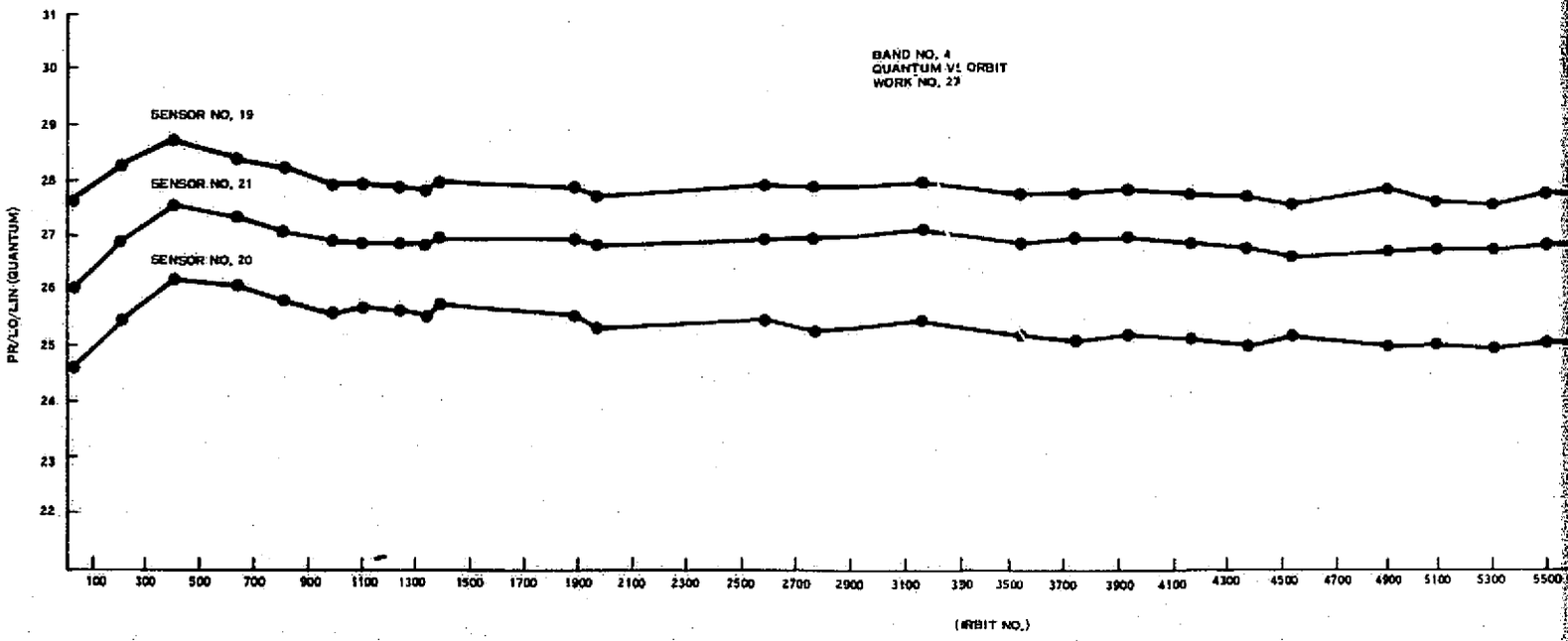
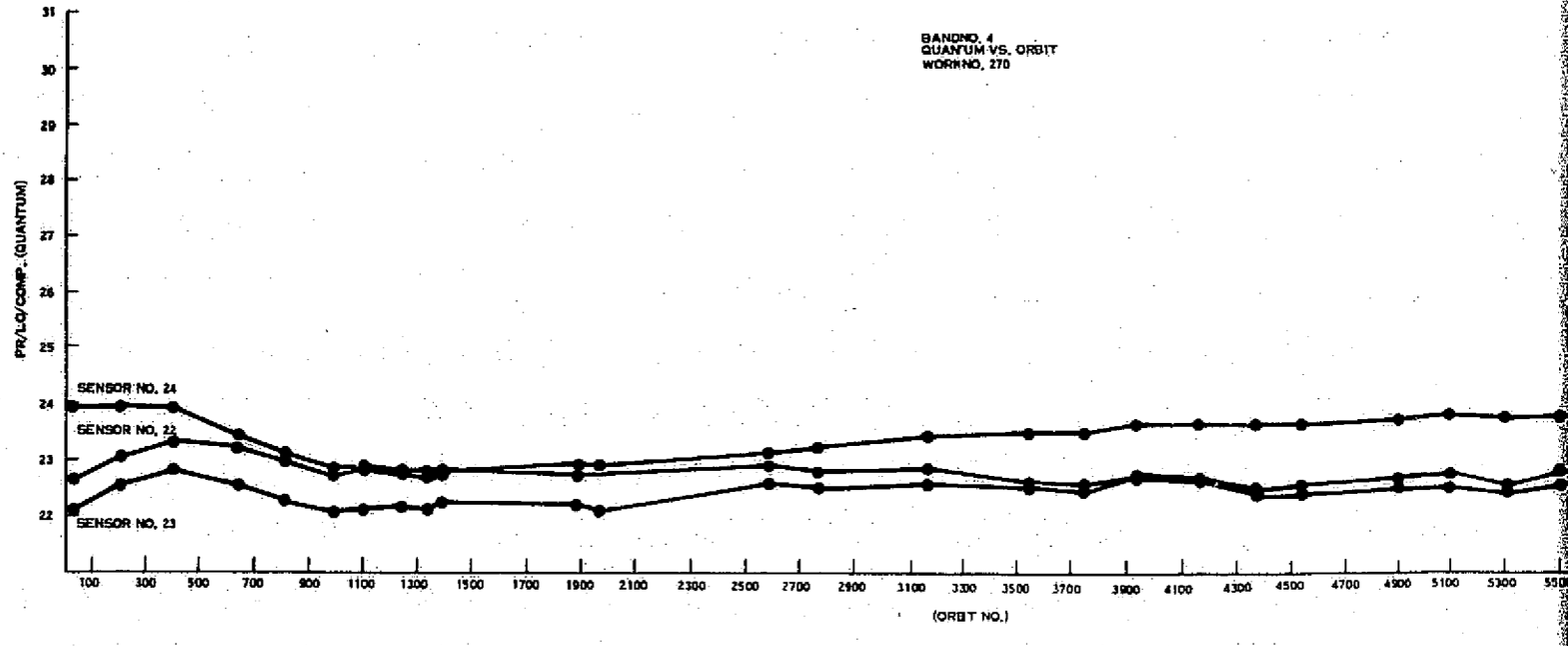


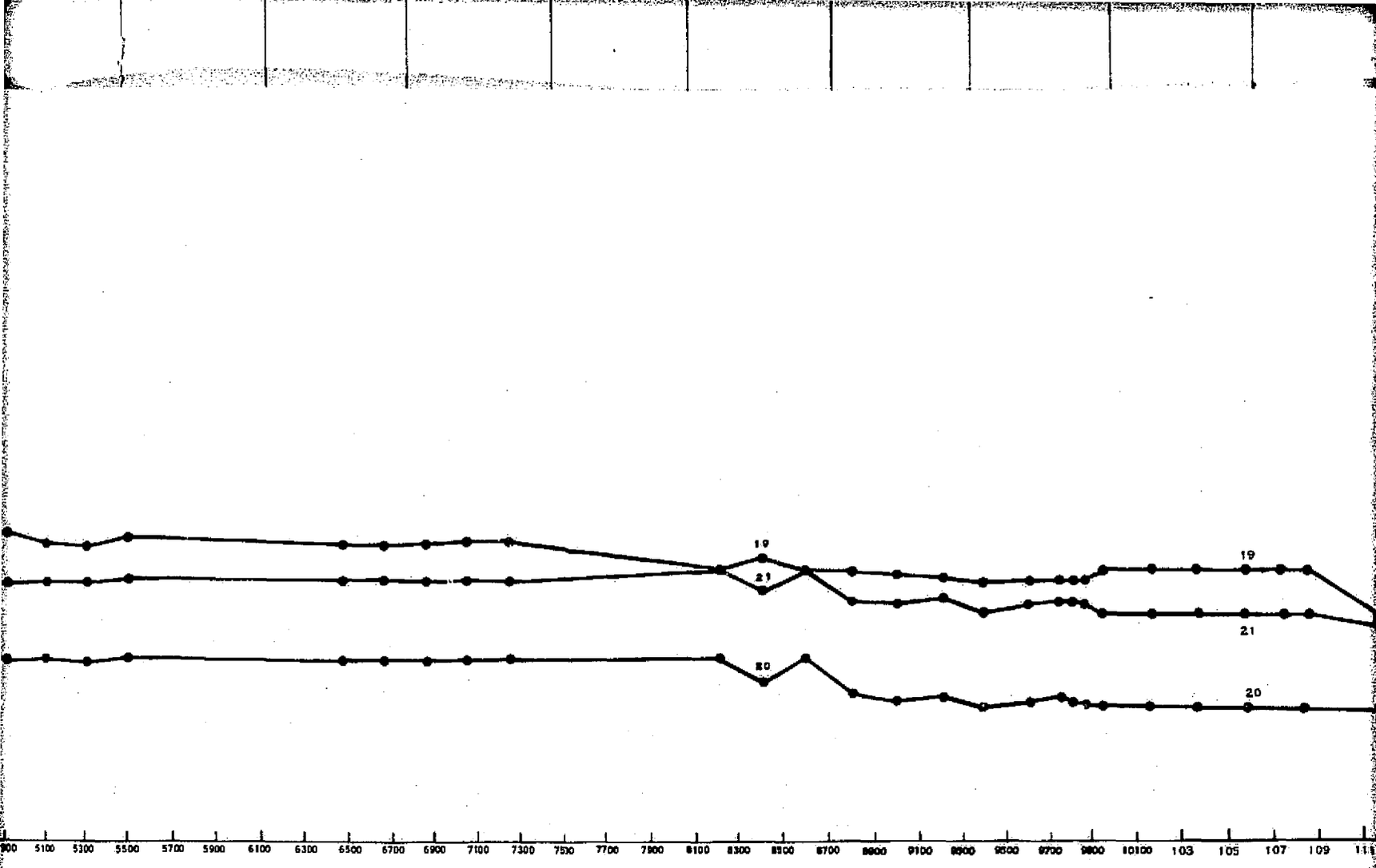
Figure 17-5. Quantum vs Orbit
(LANDSAT-1)

FOLDOUT FRAME 3 17-11/12



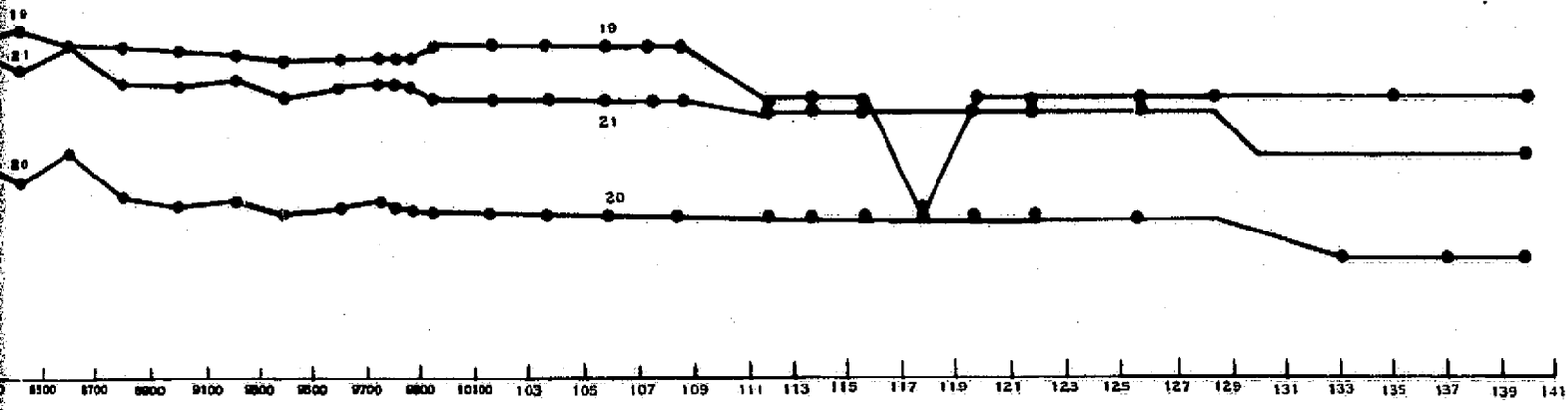


FOLDOUT FRAME /



LS-1

FOLDOUT FRAME 2



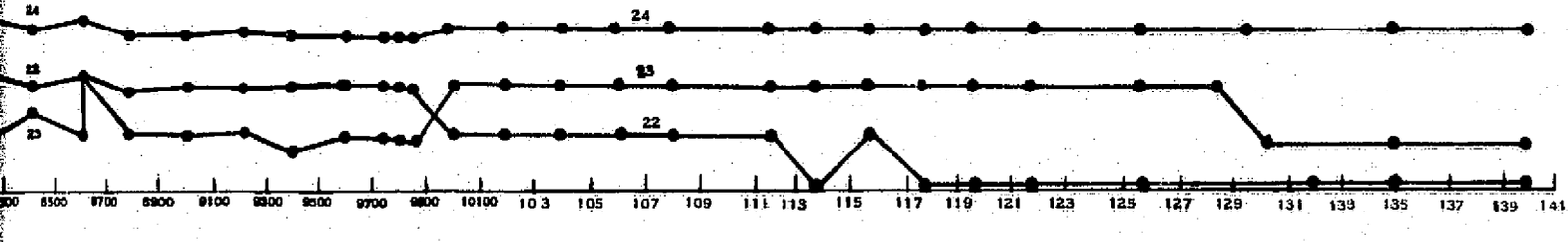
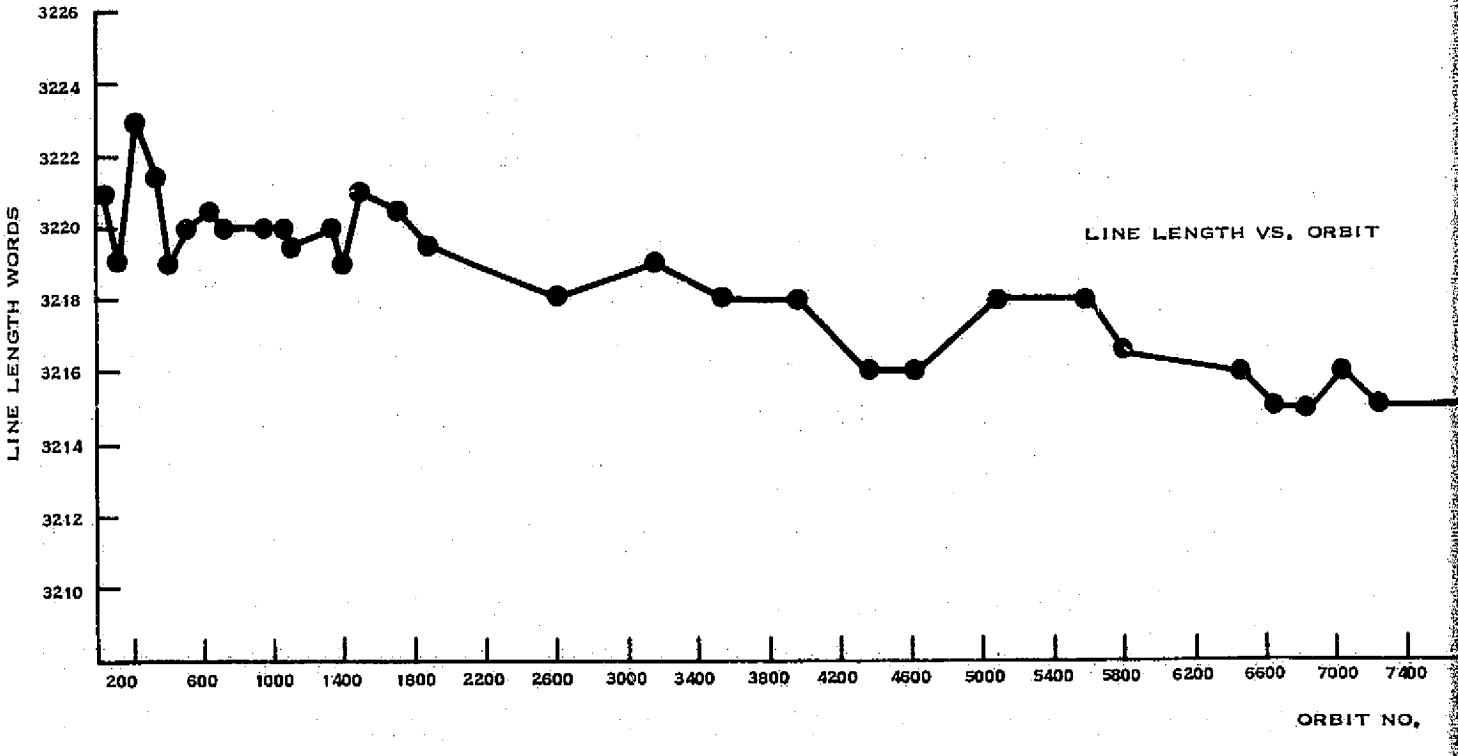


Figure 17-6. Quantum vs Orbit
(LANDSAT-1)

FOLDOUT FRAME 3



FOLDOUT FRAME 1

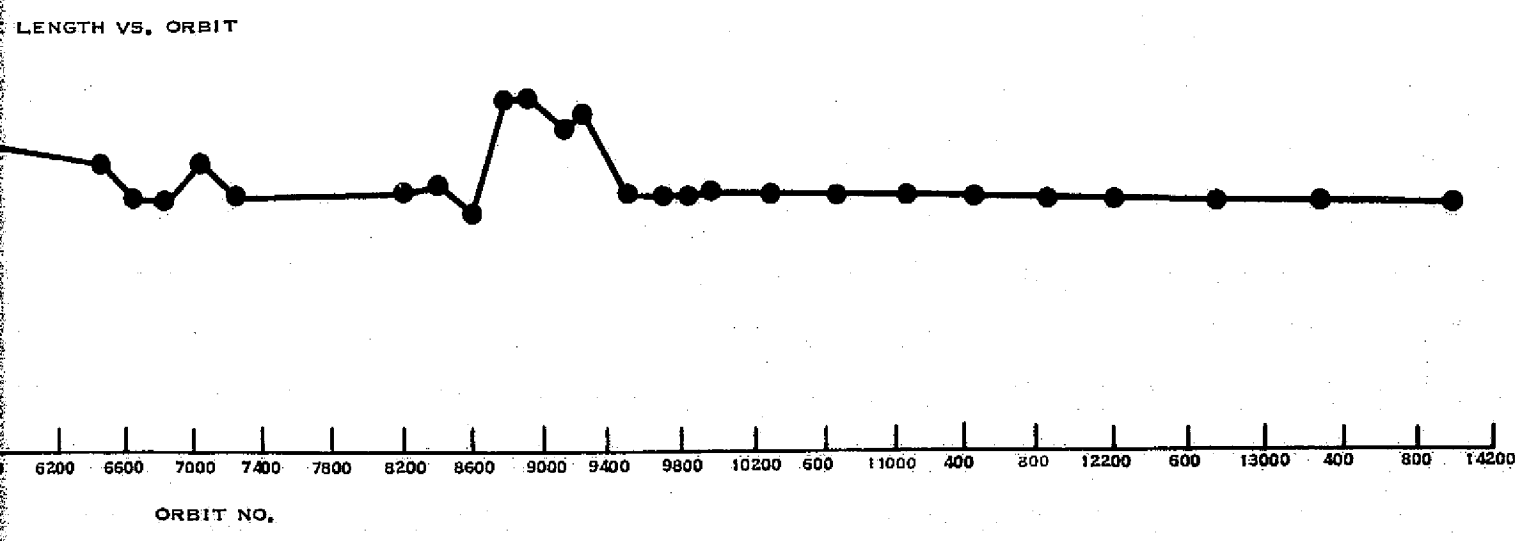


Figure 17-7. LANDSAT-1 Line Length vs Orbit

FOLDOUT FRAME 2 17-15/16

Table 17-2. LANDSAT-1 Sun Calibration Orbits

21	1012	2278	4161	6657	8943	10366	13296
47	1207	2375	4370	6852	8999	10561	13685
89	1303	2389	4537	7047	9208	10756	13880
103	1400	2473	4705	7242	9389	10951	
131	1497	2585	4900	7437	9585	11161	
214	1595	2668	5095	7633	9724	11331	
326	1692	2766	5304	7829	9766	11539	
423	1790	2964	5499	8038	9808	11733	
521	1877	3159	5861	8220	9850	11928	
619	1985	3351	5891	8413	9892	12123	
730	2082	3543	6072	8608	9975	12513	
814	2166	3742	6268	8803	10171	12918	
915	2180	3938	6463			13003	
						13100	
						13103	

Table 17-3. LANDSAT-1 MSS Operation Orbits in High Gain Mode, Mux Compressed

3967	5174	12257
3784	5216	12354
4218	5230	12368
4893	5244	12382
4907	5272	12396
4921	5286	12859
5132	5300	12873
5146	5314	12887
5160	5328	13901

LANDSAT-1 MSS Operation Orbits in High Gain Mode, Mux Linear

13124
13138
13152

SECTION 18

DATA COLLECTION SUBSYSTEM (DCS)

The Data Collection System is designed to relay data from randomly distributed Data Collection Platforms (DCP) through the LANDSAT spacecraft to either of two receiving sites at Greenbelt, Md. or Goldstone, California. The DCS system is designed to collect and provide at least one message from each of up to 1000 Data Collection Platforms in the continental United States every 12 hours, with a probability of 0.95, with a nominal LANDSAT S/C orbit and both ground stations operating.

The Data Collection Subsystem (DCS) operated satisfactorily from turn-ON in Orbit 5 thru Orbit 12690, after which it was turned OFF. The DCS in LANDSAT-2 has assumed this function since that time. For convenience and comparison, the following data is repeated.

Only Receiver 1 was used. Since turn-ON this receiver has operated for 19,704.6 hours continuously, except for an interruption of 11 hours because of ACS problems on September 29, 1974 during Orbits 11125 to 11132, and for the interval between Orbits 12608 and 12659.

Since turn-ON in Orbit 5, this subsystem has received 1,155,065 messages, of which 1,059,886 (91.8%) have been perfect. Periods of heavy interference have added false messages to both "total" messages and "imperfect" messages, diluting the apparent "error" rate, and making the "percent perfect" figure an unreliable figure of merit.

All telemetry functions have been normal as shown in the typical values of Table 18-1.

Table 18-1. DCS Telemetry Values

No.	Name	Units	Value in Orbits						
			15	2599	4811	10592	11587	12078	12565
16001	Revr 1 Sig Str	(DBM)	-124.09	-124.39	-123.36	-123.52	-123.85	-122.59	-124.03
16002	Revr 1 Temp	(DGC)	22.72	24.07	23.74	23.65	24.19	24.71	24.67
16003	Revr 1 Inp Volt	(VDC)	12.02	12.02	12.01	12.02	12.01	12.01	12.01

Figure 18-1 shows the total number of DCS messages received per 18-day cycle since launch. The number of active platforms is also plotted on the same time scale. It can be seen that when the number of active platforms reached about 100, the DCS messages received per 18-day cycle reached 28 thousand for about 9 months, decreased with the USB power drop, then rose to about 23 thousand messages per 18-day cycle. Since then, both the number of messages and active platforms have declined.

Table 18-2 shows the qualitative performance of the DCS subsystem and Table 18-3 gives statistics of messages received.

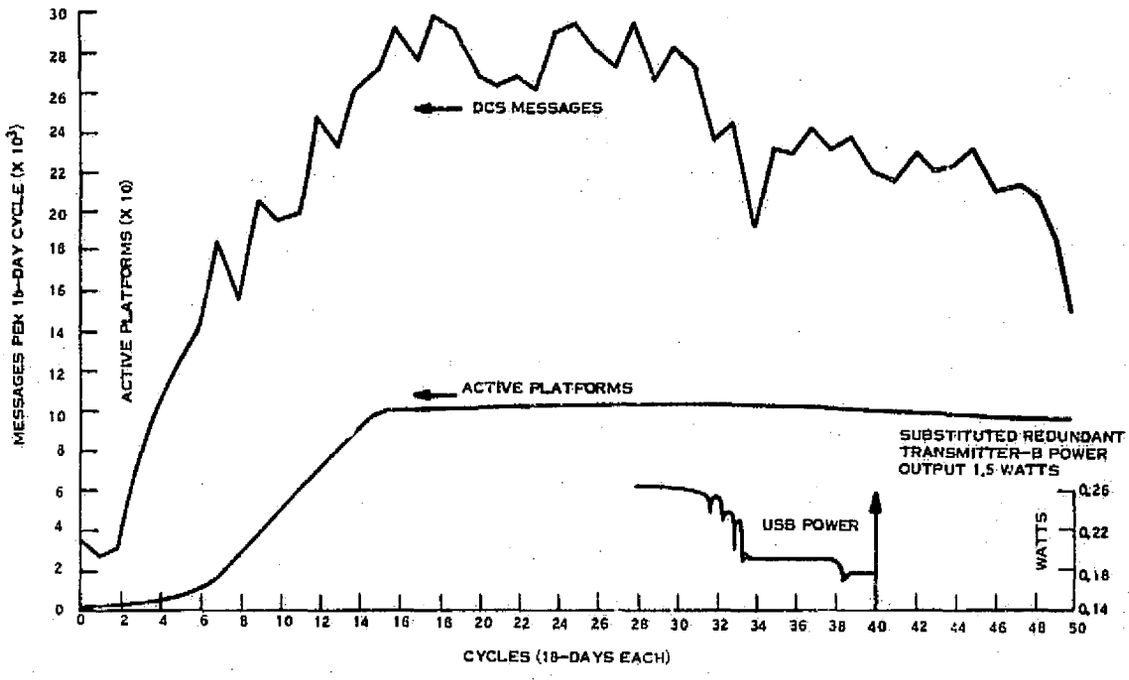


Figure 18-1. DCS Message Receipt History (LANDSAT-1)

Table 18-2. DCS Qualitative Performance (LANDSAT-1)

System Threshold	3500 km
Grazing Angle Effects	Not discernible
Adjacent DCP Interference	Not seen
Ground Transmission System	Satsifactory
Probability of Perfect Reception of any Messages During Window*	98.9%

*Window means "at times when the spacecraft is simultaneously within the horizon of the DCP and the ground receiving station".

Table 18-3. DCS Statistics (LANDSAT-1)

Through Orbit 12749	
DCS Platforms (DCP's) Shipped	224
Maximum DCP's Received per Day	107
Total Messages Received at OCC	1,155,065
Total Messages Rejected at OCC	951,179
Good Messages	91.8%
Maximum Messages per Day (9/31/74) this quarter	1,344
Number of Current Users	44

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LANDSAT-1 ANOMALIES AND OBSERVATIONS

Date	Anomaly/Observation	How Observed	Comments
7/24/72	Sun Sensor Temperature High	Off-Line	No Action Required For ERTS-1; ERTS-B Redesigned
7/24/72	Solar Paddle Temperature Excursions Greater Than Expected	Off-Line	No Action Required For ERTS-1; Math Model Corrected
7/25/72	USB Power Output Decreasing	Off-Line	Switched to Side B in Orbit 10060 on 7/15/74. Under investigation for ERTS-B. No power drops in USB side B.
8/03/72	WBVTR No. 2 Power Converter Shorted	Real Time & Off-Line	Turned All P/L Off During Pass. Formed NASA/GE/RCA Evaluation Committee. Disconnected since Anomaly. Redesigned For ERTS-B
8/03/72	Decrease in Solar Array Current	Off-Line	Evaluate Degradation Effect Due to Solar Flare Activity
8/08/72	RBV Power Transient PSM Turn-Off Failure	Real Time	Turned off PRM. NASA/GE, RCA Evaluation Committee Formed; Disconnected Since Anomaly; Redesign PSM For ERTS-B
8/10/72	DCS Reject Messages Rose to Over 40% of Total Messages for 15 Days	Off-Line	External Interference: Located Source; No Serious Interference Since.
8/10/72	MSS Cal Wedge Levels Decreasing	Off-Line	Leveled Off After Orbit 1000; At Or About 5% Below Earlier Values
8/03/72	Incorrect Time Tags in Comstor 'B' Cell 12	Real Time	Reload Comstors and Verify, (Discontinued Active Use of Cell 12)
12/04/72 12/06/72	Pitch Motor Drive Duty Cycles Roll Increased for Short Yaw Period	Off-Line	Evaluate - Prepared Contingency Plan Under Investigation For ERTS-B
3/29/73	WBVTR NO. 1; High BER	Real Time	Formed NASA/GE/RCA Committee; Lapped Heads; Now in Operational Use. Temporarily Restricted to Last 600 Feet (600 Seconds) of Tape
4/08/72	Slow Leak in Forward IR Scanner Pressure	Off-Line	Not Expected to Interfere with Normal Operations
5/20/72	Defect in Signal of Left Cosine Pot at S/C Midnight	Off-Line	Not Expected to Interfere with Normal Operations
6/03/73	Failure of Integrated Circuit Chip and TLM of Functions 6012, 1011, 12238 and 7010	Real Time & Off-Line	Tlm Failure only. S/C Operations Normal
11/5/73	WBVTR-1 Tape Unit Pressure Drop	Real Time	Defect in Pressure Instrumentation which Causes Occasional Rapid Pressure Drop in TLM - Returns to Normal
11/13/73	Solar Array Drive	Real Time	Slight Peaks on Drive Voltage Ripple which Picked up Limit Flag - Returned to Normal
11/28/73	High Head Wheel Current, WBVTR-1, During Rewind	Real Time	Resumed Operations After Investigation WBVTR-1 Performed in a Nominal Manner
12/20/73	Pitch Motor Driver Duty Cycle Increased	Real Time	Similar to Entry 12/4/72 except more Sustained
12/22/73	RMP-1 and RMP-2 Showed Excessive Noise/Output	Real Time	Condition Lasted for Several Orbits and Returned to Normal
2/20/74	Pitch Wheel Stopped During Sun Transient	Off-Line	During a sun transient in orbit 8040 the pitch flywheel was changing directions. As it passed thru zero speed, the pitch flywheel stopped and did not resume operation until 2 minutes had elapsed in spite of application of 100% clockwise pitch motor driver duty cycle during that interval.
3/5/74	WBTR #1 High BER HIGH HW-1	Real Time & Off-Line	Limited Usage of Tape Footage
3/7/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/21/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/27/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
4/2/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
5/21/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time	Similar to 12/4/72 entry.

			that interval.
3/5/74	WBTR #1 High BER HIGH HW-1	Real Time & Off-Line	Limited Usage of Tape Footage
3/7/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/21/74	WBVTR-1-high HWI	Real Time & Off-Line	Suspended operation pending study
3/27/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
4/2/74	WBVTR-1-MFSE count high	Off-Line	Suspended operation pending study
5/21/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time & Off-Line	Similar to 12/4/72 entry. Returned to normal.
7/2/74	Pitch CCW Motor Driver Duty Cycle Increased	Real Time & Off-Line	Similar to 12/4/72 entry. Returned to normal.
7/2/74	WBVTR-1-high HWI and MFSE	Real Time & Off-Line	Suspended operation pending study
8/6/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Similar to 12/4/72 entry. Returned to Normal.
8/21/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Similar to 12/4/74 entry. Returned to Normal.
8/28/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Silimar to 12/4/74 entry. Returned to Normal.
9/4/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Silimar to 12/4/72 entry. Returned to Normal.
9/9/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Similar to 12/4/72 entry. Returned to Normal.
9/14/74	PSM Power Regulator Switchover From 1 to 2	Real Time	VHF interference signal present. Occurred at 02:46:21. Spacecraft was normal.
9/23/74	PSM Power Regulator Switchover From 2 to 1	Real Time	VHF interference signal present. Occurred 01:49:17. Spacecraft is normal
9/25/74	Pitch CCW Motor Driver Duty Cycle Increase	Real Time & Off-Line	Silimar to 12/4/72 entry. Returned to Normal.
9/29/74	Pitch Flywheel Stopped	Real Time	The pitch CCW motor driver duty cycle began increasing in orbit 11120. The pitch flywheel stopped (from 400 RPM) following a sun transient in orbit 11125. After a period of approximately 8 hours, and attitude disturbances, the pitch flywheel restarted. Earth acquisition was obtained and operations returned to normal in orbit 11133.
10/9/74	RMP B Motor Current Variations	Off-Line & Real Time	As a precautionary measure a switch was made to RMP A. RMP B is still functioning and can be used in the event of RMP A failure. Switched to Side B in Orbit 10068 on 7/15/74. Under investigation for ERTS-B. No power drops in USB side B.
1/30/75	Solar Array Current Notch	On-Line	Solar array current drops 500-600 ma for 1 to 14 minutes early in the day then return to normal. Solar panel temperature range is -20 to +20°C. No effect on S/C Mission.
1/30/75	Narrow Band Recorder 2 Bit Error Rise	Real Time & Off-Line	Bit Errors began build up in Orbit 12837 and unit was turned off in Orbit 13015 on 2/12/75. Unit is approaching wear out of tape.
3/7/75	Battery 6 Turned Off	Real Time & Off-Line	Battery 6 decrease in load share and rose slightly in charge share thereby causing high overcharge. Battery temperature rose and required turn off of battery. When it discharges to 26.5 volts, it will be returned to service.

LANDSAT-1
SPACECRAFT ORBIT REFERENCE TABLES

FROM JANUARY 1975 THRU DECEMBER 1975

ORBIT 12429 THRU 17518

FLIGHT DAY 892 THRU 1256

LANDSAT-1

JAN, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	1	892	12429-12442	15- 28	2	50
2	2	893	12443-12456	29- 42	3	50
3	3	894	12457-12470	43- 56	4	50
4	4	895	12471-12484	57- 70	5	50
5	5	896	12485-12498	71- 84	6	50
6	6	897	12499-12512	85- 98	7	50
7	7	898	12513-12525	99-111	8	50
8	8	899	12526-12539	112-125	9	50
9	9	900	12540-12553	126-139	10	50
10	10	901	12554-12567	140-153	11	50
11	11	902	12568-12581	154-167	12	50
12	12	903	12582-12595	168-181	13	50
13	13	904	12596-12609	182-195	14	50
14	14	905	12610-12623	196-209	15	50
15	15	906	12624-12637	210-223	16	50
16	16	907	12638-12651	224-237	17	50
17	17	908	12652-12665	238-251	18	50
18	18	909	12666-12679	1- 14	1	51
19	19	910	12680-12693	15- 28	2	51
20	20	911	12694-12707	29- 42	3	51
21	21	912	12708-12721	43- 56	4	51
22	22	913	12722-12735	57- 70	5	51
23	23	914	12736-12749	71- 84	6	51
24	24	915	12750-12763	85- 98	7	51
25	25	916	12764-12776	99-111	8	51
26	26	917	12777-12790	112-125	9	51
27	27	918	12791-12804	126-139	10	51
28	28	919	12805-12818	140-153	11	51
29	29	920	12819-12832	154-167	12	51
30	30	921	12833-12846	168-181	13	51
31	31	922	12847-12860	182-195	14	51

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FEB, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	32	923	12861-12874	196-209	15	51
2	33	924	12875-12888	210-223	16	51
3	34	925	12889-12902	224-237	17	51
4	35	926	12903-12916	238-251	18	51
5	36	927	12917-12930	1- 14	1	52
6	37	928	12931-12944	15- 28	2	52
7	38	929	12945-12958	29- 42	3	52
8	39	930	12959-12972	43- 56	4	52
9	40	931	12973-12986	57- 70	5	52
10	41	932	12987-13000	71- 84	6	52
11	42	933	13001-13014	85- 98	7	52
12	43	934	13015-13027	99-111	8	52
13	44	935	13028-13041	112-125	9	52
14	45	936	13042-13055	126-139	10	52
15	46	937	13056-13069	140-153	11	52
16	47	938	13070-13083	154-167	12	52
17	48	939	13084-13097	168-181	13	52
18	49	940	13098-13111	182-195	14	52
19	50	941	13112-13125	196-209	15	52
20	51	942	13126-13139	210-223	16	52
21	52	943	13140-13153	224-237	17	52
22	53	944	13154-13167	238-251	18	52
23	54	945	13168-13181	1- 14	1	53
24	55	946	13182-13195	15- 28	2	53
25	56	947	13196-13209	29- 42	3	53
26	57	948	13210-13223	43- 56	4	53
27	58	949	13224-13237	57- 70	5	53
28	59	950	13238-13251	71- 84	6	53

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MAR, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	60	951	13252-13265	85- 98	7	53
2	61	952	13266-13278	99-111	8	53
3	62	953	13279-13292	112-125	9	53
4	63	954	13293-13306	126-139	10	53
5	64	955	13307-13320	140-153	11	53
6	65	956	13321-13334	154-167	12	53
7	66	957	13335-13348	168-181	13	53
8	67	958	13349-13362	182-195	14	53
9	68	959	13363-13376	196-209	15	53
10	69	960	13377-13390	210-223	16	53
11	70	961	13391-13404	224-237	17	53
12	71	962	13405-13418	238-251	18	53
13	72	963	13419-13432	1- 14	1	54
14	73	964	13433-13446	15- 28	2	54
15	74	965	13447-13460	29- 42	3	54
16	75	966	13461-13474	43- 56	4	54
17	76	967	13475-13488	57- 70	5	54
18	77	968	13489-13502	71- 84	6	54
19	78	969	13503-13516	85- 98	7	54
20	79	970	13517-13529	99-111	8	54
21	80	971	13530-13543	112-125	9	54
22	81	972	13544-13557	126-139	10	54
23	82	973	13558-13571	140-153	11	54
24	83	974	13572-13585	154-167	12	54
25	84	975	13586-13599	168-181	13	54
26	85	976	13600-13613	182-195	14	54
27	86	977	13614-13627	196-209	15	54
28	87	978	13628-13641	210-223	16	54
29	88	979	13642-13655	224-237	17	54
30	89	980	13656-13669	238-251	18	54
31	90	981	13670-13683	1- 14	1	55

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APR. 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	91	982	13684-13697	15- 28	2	55
2	92	983	13698-13711	29- 42	3	55
3	93	984	13712-13725	43- 56	4	55
4	94	985	13726-13739	57- 70	5	55
5	95	986	13740-13753	71- 84	6	55
6	96	987	13754-13767	85- 98	7	55
7	97	988	13768-13780	99-111	8	55
8	98	989	13781-13794	112-125	9	55
9	99	990	13795-13808	126-139	10	55
10	100	991	13809-13822	140-153	11	55
11	101	992	13823-13836	154-167	12	55
12	102	993	13837-13850	168-181	13	55
13	103	994	13851-13864	182-195	14	55
14	104	995	13865-13878	196-209	15	55
15	105	996	13879-13892	210-223	16	55
16	106	997	13893-13906	224-237	17	55
17	107	998	13907-13920	238-251	18	55
18	108	999	13921-13934	1- 14	1	56
19	109	1000	13935-13948	15- 28	2	56
20	110	1001	13949-13962	29- 42	3	56
21	111	1002	13963-13976	43- 56	4	56
22	112	1003	13977-13990	57- 70	5	56
23	113	1004	13991-14004	71- 84	6	56
24	114	1005	14005-14018	85- 98	7	56
25	115	1006	14019-14031	99-111	8	56
26	116	1007	14032-14045	112-125	9	56
27	117	1008	14046-14059	126-139	10	56
28	118	1009	14060-14073	140-153	11	56
29	119	1010	14074-14087	154-167	12	56
30	120	1011	14088-14101	168-181	13	56

LANDSAT-1

MAY, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	121	1012	14102-14115	182-195	14	56
2	122	1013	14116-14129	196-209	15	56
3	123	1014	14130-14143	210-223	16	56
4	124	1015	14144-14157	224-237	17	56
5	125	1016	14158-14171	238-251	18	56
6	126	1017	14172-14185	1- 14	1	57
7	127	1018	14186-14199	15- 28	2	57
8	128	1019	14200-14213	29- 42	3	57
9	129	1020	14214-14227	43- 56	4	57
10	130	1021	14228-14241	57- 70	5	57
11	131	1022	14242-14255	71- 84	6	57
12	132	1023	14256-14269	85- 98	7	57
13	133	1024	14270-14282	99-111	8	57
14	134	1025	14283-14296	112-125	9	57
15	135	1026	14297-14310	126-139	10	57
16	136	1027	14311-14324	140-153	11	57
17	137	1028	14325-14338	154-167	12	57
18	138	1029	14339-14352	168-181	13	57
19	139	1030	14353-14366	182-195	14	57
20	140	1031	14367-14380	196-209	15	57
21	141	1032	14381-14394	210-223	16	57
22	142	1033	14395-14408	224-237	17	57
23	143	1034	14409-14422	238-251	18	57
24	144	1035	14423-14436	1- 14	1	58
25	145	1036	14437-14450	15- 28	2	58
26	146	1037	14451-14464	29- 42	3	58
27	147	1038	14465-14478	43- 56	4	58
28	148	1039	14479-14492	57- 70	5	58
29	149	1040	14493-14506	71- 84	6	58
30	150	1041	14507-14520	85- 98	7	58
31	151	1042	14521-14533	99-111	8	58

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JUNE 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	152	1043	14534-14547	112-125	9	58
2	153	1044	14548-14561	126-139	10	58
3	154	1045	14562-14575	140-153	11	58
4	155	1046	14576-14589	154-167	12	58
5	156	1047	14590-14603	168-181	13	58
6	157	1048	14604-14617	182-195	14	58
7	158	1049	14618-14631	196-209	15	58
8	159	1050	14632-14645	210-223	16	58
9	160	1051	14646-14659	224-237	17	58
10	161	1052	14660-14673	238-251	18	58
11	162	1053	14674-14687	1- 14	1	59
12	163	1054	14688-14701	15- 28	2	59
13	164	1055	14702-14715	29- 42	3	59
14	165	1056	14716-14729	43- 56	4	59
15	166	1057	14730-14743	57- 70	5	59
16	167	1058	14744-14757	71- 84	6	59
17	168	1059	14758-14771	85- 98	7	59
18	169	1060	14772-14784	99-111	8	59
19	170	1061	14785-14798	112-125	9	59
20	171	1062	14799-14812	126-139	10	59
21	172	1063	14813-14826	140-153	11	59
22	173	1064	14827-14840	154-167	12	59
23	174	1065	14841-14854	168-181	13	59
24	175	1066	14855-14868	182-195	14	59
25	176	1067	14869-14882	196-209	15	59
26	177	1068	14883-14896	210-223	16	59
27	178	1069	14897-14910	224-237	17	59
28	179	1070	14911-14924	238-251	18	59
29	180	1071	14925-14938	1- 14	1	60
30	181	1072	14939-14952	15- 28	2	60

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JUL, 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	1073	14953-14966	29- 42	3	60
2	183	1074	14967-14980	43- 56	4	60
3	184	1075	14981-14994	57- 70	5	60
4	185	1076	14995-15008	71- 84	6	60
5	186	1077	15009-15022	85- 98	7	60
6	187	1078	15023-15035	99-111	8	60
7	188	1079	15036-15049	112-125	9	60
8	189	1080	15050-15063	126-139	10	60
9	190	1081	15064-15077	140-153	11	60
10	191	1082	15078-15091	154-167	12	60
11	192	1083	15092-15105	168-181	13	60
12	193	1084	15106-15119	182-195	14	60
13	194	1085	15120-15133	196-209	15	60
14	195	1086	15134-15147	210-223	16	60
15	196	1087	15148-15161	224-237	17	60
16	197	1088	15162-15175	238-251	18	60
17	198	1089	15176-15189	1- 14	1	61
18	199	1090	15190-15203	15- 28	2	61
19	200	1091	15204-15217	29- 42	3	61
20	201	1092	15218-15231	43- 56	4	61
21	202	1093	15232-15245	57- 70	5	61
22	203	1094	15246-15259	71- 84	6	61
23	204	1095	15260-15273	85- 98	7	61
24	205	1096	15274-15286	99-111	8	61
25	206	1097	15287-15300	112-125	9	61
26	207	1098	15301-15314	126-139	10	61
27	208	1099	15315-15328	140-153	11	61
28	209	1100	15329-15342	154-167	12	61
29	210	1101	15343-15356	168-181	13	61
30	211	1102	15357-15370	182-195	14	61
31	212	1103	15371-15384	196-209	15	61

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AUG. 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	1104	15385-15398	210-223	16	61
2	214	1105	15399-15412	224-237	17	61
3	215	1106	15413-15426	238-251	18	61
4	216	1107	15427-15440	1- 14	1	62
5	217	1108	15441-15454	15- 28	2	62
6	218	1109	15455-15468	29- 42	3	62
7	219	1110	15469-15482	43- 56	4	62
8	220	1111	15483-15496	57- 70	5	62
9	221	1112	15497-15510	71- 84	6	62
10	222	1113	15511-15524	85- 98	7	62
11	223	1114	15525-15537	99-111	8	62
12	224	1115	15538-15551	112-125	9	62
13	225	1116	15552-15565	126-139	10	62
14	226	1117	15566-15579	140-153	11	62
15	227	1118	15580-15593	154-167	12	62
16	228	1119	15594-15607	168-181	13	62
17	229	1120	15608-15621	182-195	14	62
18	230	1121	15622-15635	196-209	15	62
19	231	1122	15636-15649	210-223	16	62
20	232	1123	15650-15663	224-237	17	62
21	233	1124	15664-15677	238-251	18	62
22	234	1125	15678-15691	1- 14	1	63
23	235	1126	15692-15705	15- 28	2	63
24	236	1127	15706-15719	29- 42	3	63
25	237	1128	15720-15733	43- 56	4	63
26	238	1129	15734-15747	57- 70	5	63
27	239	1130	15748-15761	71- 84	6	63
28	240	1131	15762-15775	85- 98	7	63
29	241	1132	15776-15788	99-111	8	63
30	242	1133	15789-15802	112-125	9	63
31	243	1134	15803-15816	126-139	10	63

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SEP. 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	1135	15817-15830	140-153	11	63
2	245	1136	15831-15844	154-167	12	63
3	246	1137	15845-15858	168-181	13	63
4	247	1138	15859-15872	182-195	14	63
5	248	1139	15873-15886	196-209	15	63
6	249	1140	15887-15900	210-223	16	63
7	250	1141	15901-15914	224-237	17	63
8	251	1142	15915-15928	238-251	18	63
9	252	1143	15929-15942	1- 14	1	64
10	253	1144	15943-15956	15- 28	2	64
11	254	1145	15957-15970	29- 42	3	64
12	255	1146	15971-15984	43- 56	4	64
13	256	1147	15985-15998	57- 70	5	64
14	257	1148	15999-16012	71- 84	6	64
15	258	1149	16013-16026	85- 98	7	64
16	259	1150	16027-16039	99-111	8	64
17	260	1151	16040-16053	112-125	9	64
18	261	1152	16054-16067	126-139	10	64
19	262	1153	16068-16081	140-153	11	64
20	263	1154	16082-16095	154-167	12	64
21	264	1155	16096-16109	168-181	13	64
22	265	1156	16110-16123	182-195	14	64
23	266	1157	16124-16137	196-209	15	64
24	267	1158	16138-16151	210-223	16	64
25	268	1159	16152-16165	224-237	17	64
26	269	1160	16166-16179	238-251	18	64
27	270	1161	16180-16193	1- 14	1	65
28	271	1162	16194-16207	15- 28	2	65
29	272	1163	16208-16221	29- 42	3	65
30	273	1164	16222-16235	43- 56	4	65

LANDSAT-1

OCT.1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	1165	16236-16249	57- 70	5	45
2	275	1166	16250-16263	71- 84	6	45
3	276	1167	16264-16277	85- 98	7	45
4	277	1168	16278-16290	99-111	8	45
5	278	1169	16291-16304	112-125	9	45
6	279	1170	16305-16318	126-139	10	45
7	280	1171	16319-16332	140-153	11	45
8	281	1172	16333-16346	154-167	12	45
9	282	1173	16347-16360	168-181	13	45
10	283	1174	16361-16374	182-195	14	45
11	284	1175	16375-16388	196-209	15	45
12	285	1176	16389-16402	210-223	16	45
13	286	1177	16403-16416	224-237	17	45
14	287	1178	16417-16430	238-251	18	45
15	288	1179	16431-16444	1- 14	1	46
16	289	1180	16445-16458	15- 28	2	46
17	290	1181	16459-16472	29- 42	3	46
18	291	1182	16473-16486	43- 56	4	46
19	292	1183	16487-16500	57- 70	5	46
20	293	1184	16501-16514	71- 84	6	46
21	294	1185	16515-16528	85- 98	7	46
22	295	1186	16529-16541	99-111	8	46
23	296	1187	16542-16555	112-125	9	46
24	297	1188	16556-16569	126-139	10	46
25	298	1189	16570-16583	140-153	11	46
26	299	1190	16584-16597	154-167	12	46
27	300	1191	16598-16611	168-181	13	46
28	301	1192	16612-16625	182-195	14	46
29	302	1193	16626-16639	196-209	15	46
30	303	1194	16640-16653	210-223	16	46
31	304	1195	16654-16667	224-237	17	46

LANDSAT-1

NOV. 1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE No.
1	305	1196	16668-16681	238-251	18	46
2	306	1197	16682-16695	1- 14	1	47
3	307	1198	16696-16709	15- 28	2	47
4	308	1199	16710-16723	29- 42	3	47
5	309	1200	16724-16737	43- 56	4	47
6	310	1201	16738-16751	57- 70	5	47
7	311	1202	16752-16765	71- 84	6	47
8	312	1203	16766-16779	85- 98	7	47
9	313	1204	16780-16792	99-111	8	47
10	314	1205	16793-16806	112-125	9	47
11	315	1206	16807-16820	126-139	10	47
12	316	1207	16821-16834	140-153	11	47
13	317	1208	16835-16848	154-167	12	47
14	318	1209	16849-16862	168-181	13	47
15	319	1210	16863-16876	182-195	14	47
16	320	1211	16877-16890	196-209	15	47
17	321	1212	16891-16904	210-223	16	47
18	322	1213	16905-16918	224-237	17	47
19	323	1214	16919-16932	238-251	18	47
20	324	1215	16933-16946	1- 14	1	48
21	325	1216	16947-16960	15- 28	2	48
22	326	1217	16961-16974	29- 42	3	48
23	327	1218	16975-16988	43- 56	4	48
24	328	1219	16989-17002	57- 70	5	48
25	329	1220	17003-17016	71- 84	6	48
26	330	1221	17017-17030	85- 98	7	48
27	331	1222	17031-17043	99-111	8	48
28	332	1223	17044-17057	112-125	9	48
29	333	1224	17058-17071	126-139	10	48
30	334	1225	17072-17085	140-153	11	48

C12

LANDSAT-1

DEC.1975

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	1226	17086-17099	154-167	12	68
2	336	1227	17100-17113	168-181	13	68
3	337	1228	17114-17127	182-195	14	68
4	338	1229	17128-17141	196-209	15	68
5	339	1230	17142-17155	210-223	16	68
6	340	1231	17156-17169	224-237	17	68
7	341	1232	17170-17183	238-251	18	68
8	342	1233	17184-17197	1- 14	1	69
9	343	1234	17198-17211	15- 28	2	69
10	344	1235	17212-17225	29- 42	3	69
11	345	1236	17226-17239	43- 56	4	69
12	346	1237	17240-17253	57- 70	5	69
13	347	1238	17254-17267	71- 84	6	69
14	348	1239	17268-17281	85- 98	7	69
15	349	1240	17282-17294	99-111	8	69
16	350	1241	17295-17308	112-125	9	69
17	351	1242	17309-17322	126-139	10	69
18	352	1243	17323-17336	140-153	11	69
19	353	1244	17337-17350	154-167	12	69
20	354	1245	17351-17364	168-181	13	69
21	355	1246	17365-17378	182-195	14	69
22	356	1247	17379-17392	196-209	15	69
23	357	1248	17393-17406	210-223	16	69
24	358	1249	17407-17420	224-237	17	69
25	359	1250	17421-17434	238-251	18	69
26	360	1251	17435-17448	1- 14	1	70
27	361	1252	17449-17462	15- 28	2	70
28	362	1253	17463-17476	29- 42	3	70
29	363	1254	17477-17490	43- 56	4	70
30	364	1255	17491-17504	57- 70	5	70
31	365	1256	17505-17518	71- 84	6	70

GENERAL ELECTRIC
SPACE DIVISION
PHILADELPHIA

PROGRAM INFORMATION REQUEST / RELEASE

PIR NO.	*CLASS. LTR.	OPERATION	PROGRAM	SEQUENCE NO.	REV. LTR.
	U	1N23	ERTS	133	

*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FM	TO
K.S. Rizk	T.W. Winchester

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
4/23/75			

SUBJECT

WBVTR-1 REWIND ANOMALY, LANDSAT-2

INFORMATION REQUESTED/RELEASED

INTRODUCTION

During Orbit 1021 on 5 April 1975, WBVTR-1 in LANDSAT-2 failed to rewind, although it was commanded to do so five times.

DISCUSSION

On 5 April 1975 during Orbit 1021, WBVTR-1 received a pre-pass ECAM stored command to Rewind at 23:08:45. The Recorder Input Current showed successive 1-second samples of 1.81, 2.30, 2.23 and 1.81 amperes spanning the interval from 1 second before to 2 seconds after the Rewind command.

The Rewind Relay contacts closed, verified by telemetry. However, the next telemetry sample, 16 seconds later showed the Rewind Relay open. Capstan Current, sampled 10 seconds after the command, read zero, and no search track signal resulted, indicating that there was no tape motion.

When the real-time pass at Alaska started, Playback was commanded, on the assumption that the stored Rewind Command had executed properly. When it was realized that the tape footage was not at the scheduled place, playback was stopped at 23:16:14, and three real-time commands were given to Rewind at 23:17:16, 23:18:19, 23:19:35. Each of these commands resulted in the same brief rise in Recorder Input Current described above, but as before no Search Track Signal or Capstan Current was detected.

After the real-time pass the pre-stored ECAM again commanded a Rewind (the fifth attempt) at 23:23:23 with identical results as before.

At 23:42:57 ECAM commanded a pre-stored Record Operation, in which WBVTR-1 functioned normally, with Recorder input current of 3.67 amperes, Capstan current of 0.28 amperes and Headwheel current of 0.49 to 0.51 amperes.

The footage used in the on-pass playback was from 1331 to 1534 ft. The five attempted rewinds did not move the tape. The footage used in the final record was from 1534 to 1602.5 ft. The tape has not been moved since.

Table 1a lists the real-time commands transmitted to the spacecraft during the pass. The ECAM stored commands are shown in Table 1b.

Dist:		
P.L. Smith	H. Boys	G. Ehrgott
J. Hayes	L. Gonzales	F. Putzrath-RCA
C. Powell	OS 420	F. Lee-RCA
R. Stauffer	D. Haykin-~~730.2~~	R. Moore-RCA
D. Schwartz	R. Davidson-312	D. Wise
B. Phucas	J. Lesko-725	K. Rizk (4)

PAGE NO. ____ OF ____

RETENTION REQUIREMENTS

COPIES FOR	MASTERS FOR
1 MO.	3 MOS.
3 MOS.	6 MOS.
6 MOS.	12 MOS.
MOS.	MOS.
	DO NOT DESTROY

ERTR A COMMAND HISTORY
KTRANS FILE NO. 010 DETAILED COMMAND HISTORY

LINE	MSG	CMD	CMD NAME	GMT/RETR	ETIME
010	004	840	TIC/TAC SEQUENCE	23:11:46	
020		373	VERIFY TICK	23:11:47	
030		000	SPARE	23:11:47	
040		000	SPARE	23:11:48	
050		000	SPARE	23:11:48	
060		000	SPARE	23:11:48	
070		000	SPARE	23:11:49	
080		000	SPARE	23:11:49	
090		457	VERIFY TOCK	23:11:50	
100	005	820	WBR 1 PB*B	23:12:39TT.	
110		722	INH DATA/RAV FLT B	23:12:40	
120		000	SPARE	23:12:40	
130		000	SPARE	23:12:41	
140		607	WBVTR 1 BN (PRIM)	23:12:41	
150		000	SPARE	23:12:41	
160		760	INH DATA/MSS FLT B	23:12:42	
170		000	SPARE	23:12:42	
180		000	SPARE	23:12:43	
190		505	MSR STANDBY 1	23:12:43	
200		000	SPARE	23:12:43	
210		537	TR 1 DATA/MSS FLT B	23:12:44	
220		000	SPARE	23:12:44	
230		000	SPARE	23:12:45	
240		000	SPARE	23:12:45	
250		000	SPARE	23:12:45	
260		000	SPARE	23:12:46	
270		000	SPARE	23:12:46	
280		000	SPARE	23:12:47	
290		000	SPARE	23:12:47	
300		000	SPARE	23:12:47	
310		447	WBR PLAYBACK 1	23:12:48	
320	006	808	NBP1	23:13:06	
330		646	PMP SEL NBTR 1	23:13:07	
340		000	SPARE	23:13:07	
350		800	SPARE	23:13:08	
360		621	NBR REC 1 P/B MODE	23:13:08	
370	009	505	MSR STANDBY 1	23:16:01TT	
380		505	MSR STANDBY 1	23:15:17	
390	010	505	MSR STANDBY 1	23:16:10	
400		505	MSR STANDBY 1	23:16:11	
410	011	445	FAST REWIND 1	23:17:15	
420		445	FAST REWIND 1	23:17:16	
430	012	806	LPALA OFF	23:17:54	
440		047	WPA POWER OFF 2	23:17:55	
450		000	SPARE	23:17:55	
460		000	SPARE	23:17:56	
470		000	SPARE	23:17:56	
480		000	SPARE	23:17:56	
490		561	WPA POWER OFF 1	23:17:57	
500		000	SPARE	23:17:57	

TABLE 1a

COMMAND HISTORY - ORBIT 1021

ERTR A COMMAND HISTORY
KTRANS FILE NO. 010 DETAILED COMMAND HISTORY

LINE	MSG	CMD	CMD NAME	GMT/RETR	ETIME
010		000	SPARE	23:17:58	
020		000	SPARE	23:17:58	
030		000	SPARE	23:17:58	
040		566	WFM INV A POWER OFF	23:17:59	
050	013	465	FAST REWIND 1	23:18:17	
060		465	FAST REWIND 1	23:18:18	
070	014	607	WBVTR 1 ON (PRIM)	23:18:49	
080		607	WBVTR 1 ON (PRIM)	23:18:50	
090	015	505	MSS STANDBY 1	23:19:07	
100		505	MSS STANDBY 1	23:19:08	
110	017	465	FAST REWIND 1	23:19:33	
120		465	FAST REWIND 1	23:19:34	
130	018	505	MSS STANDBY 1	23:20:03	
140		505	MSS STANDBY 1	23:20:04	
150	019	651	WBVTR 1 OFF	23:20:18	
160		651	WBVTR 1 OFF	23:20:19	
170	020	803	USRF	23:21:49	
180		665	RMP MODULATOR B OFF	23:21:50	
190		000	SPARE	23:21:50	
200		000	SPARE	23:21:51	
210		000	SPARE	23:21:51	
220		000	SPARE	23:21:51	
230		757	DISABLE USR XMTRS	23:21:52	
240	021	357	AUX LOAD 2 ON	23:22:47	
250		357	AUX LOAD 2 ON	23:22:48	
260	022	105	FCAM RUN A/LOAD B	23:23:38	
270		105	FCAM RUN A/LOAD B	23:23:39	
280	023	651	WBVTR 1 OFF	23:23:59	
290		651	WBVTR 1 OFF	23:24:00	

STOP 0

TABLE 1b

ECAM STORED COMMANDS FOR WBR-1

LANDSAT-2 ORBIT 1021

PRE PASS TIME	CMD	DESCRIPTION
23:08:38	607	WBR-1 ON
:40	505	STBY
:45	465	R/W
23:10:38	505	STBY
:40	651	OFF

POST PASG TIME	CMD	DESCRIPTION
23:23:16	607	WBV-1 ON
:18	505	STBY
:23	465	R/W
23:25:09	505	STBY
:11	651	OFF
23:42:50	607	WBR-1 ON
:52	505	STBY
:57	426	RECORD
23:44:08	505	STBY
:10	651	OFF

Figures 1 and 2 are the Brush Chart recording of WBVTR-1 telemetry values thru the periods of WBR activity in orbit 1021. The average values shown on these charts are given in Table 2. These values are normal. Temperatures are about record lows for orbital data, but not out of limits. Since launch, the temperature of the transport unit has varied from the low of Orbit 1021 (16.7°) to a high of 20.74°. The average is about 18.3°. The Electronic Unit has varied from the low of Orbit 1021 (13.1°) to a high of 25°. Average is about 14.6°. Brush charts of the preceding thirty orbits show identical values; the single difference being the sudden rewind failure.

An item of interest is the 2-second rise in Recorder Input Current at each Rewind Command, as described in the opening of the Discussion. This rise may also be seen in Figure 1 for each time the Rewind command is given. This is very similar in appearance and magnitude to that seen in LANDSAT-1 when Record was commanded in the Lap Section without being preceded by the Lap Command. In orbit 8646 a Lap operation was planned. The sequence of Commands, however, neglected to precede each tape motion (Record Command) with the Lap command. Of the 9 Lap activities planned, only 4 were preceded with the LAP command. See Table 3 and Figure 3. These resulted in a current increase of 1.45 amperes. The Record Commands without the Lap preceding them resulted in a current increase of only 0.54 amperes. This value may be compared with the 0.43 amperes which was the average increase of the 5 rewind attempts in Orbit 1021 in LANDSAT-2.

Until Orbit 1021, WBVTR-1 had functioned normally in all respects.

Tape usage by footage is shown in Figure 4.

WBR-1 has operated since launch for a total of 64.35 hours. The head-to-tape contact time in orbit has been 52.8 hours. Combined with pre-launch head-to-tape contact time of 522 hours, the total head-to-tape contact time has been 574.8 hours, compared to its expecced life of 1000 hours. In orbit, the number of ON-OFF cycles was 860.

K. S. Rizk

K.S. Rizk
Systems Engineer

/pkp

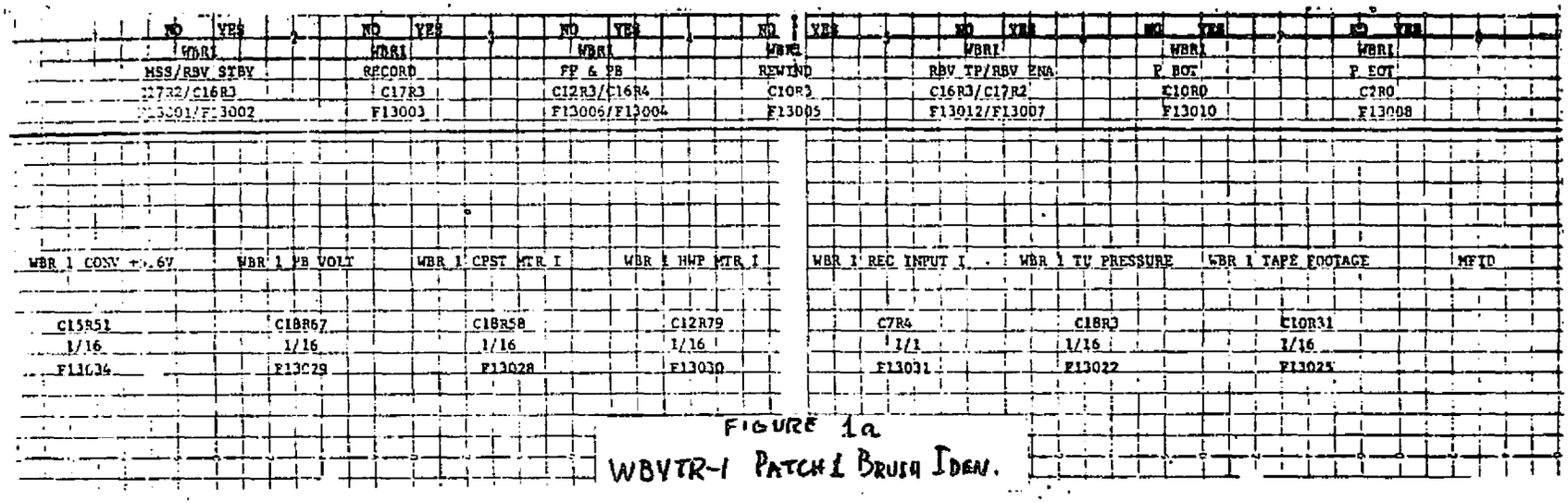


FIGURE 1a
WBVTR-1 PATCH & BRUSH IDEN.

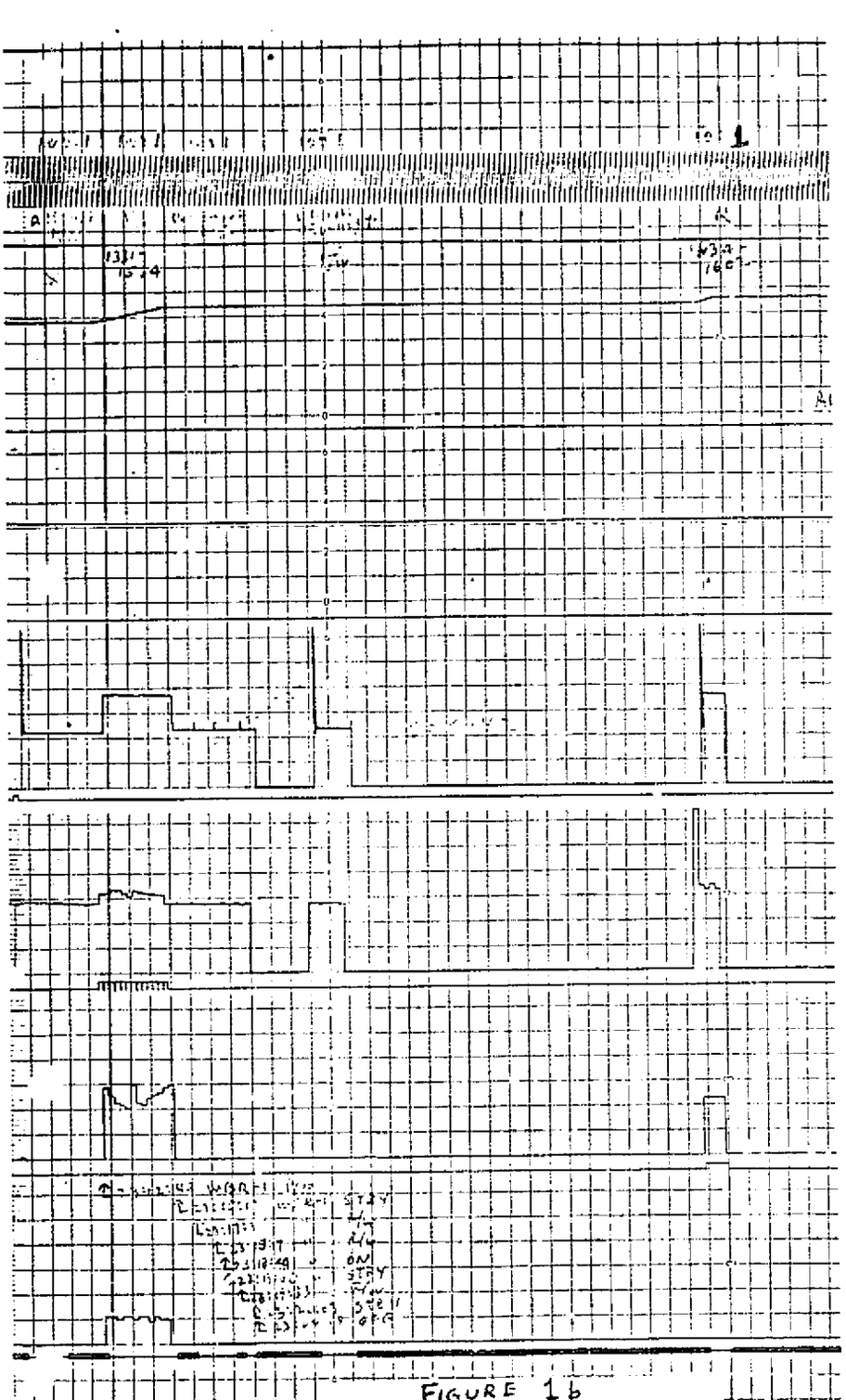


FIGURE 1b
WBVTR-1 PATCH 1 BRUSH VALUES

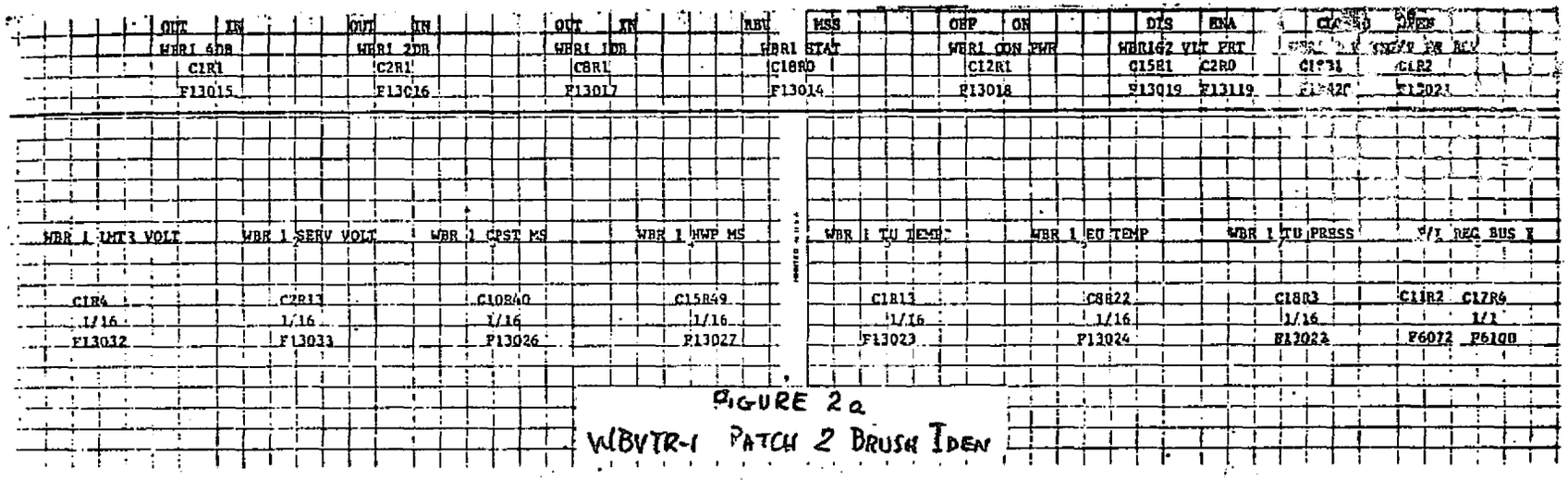


FIGURE 2a
WBVTR-1 PATCH 2 BRUSH IDEN

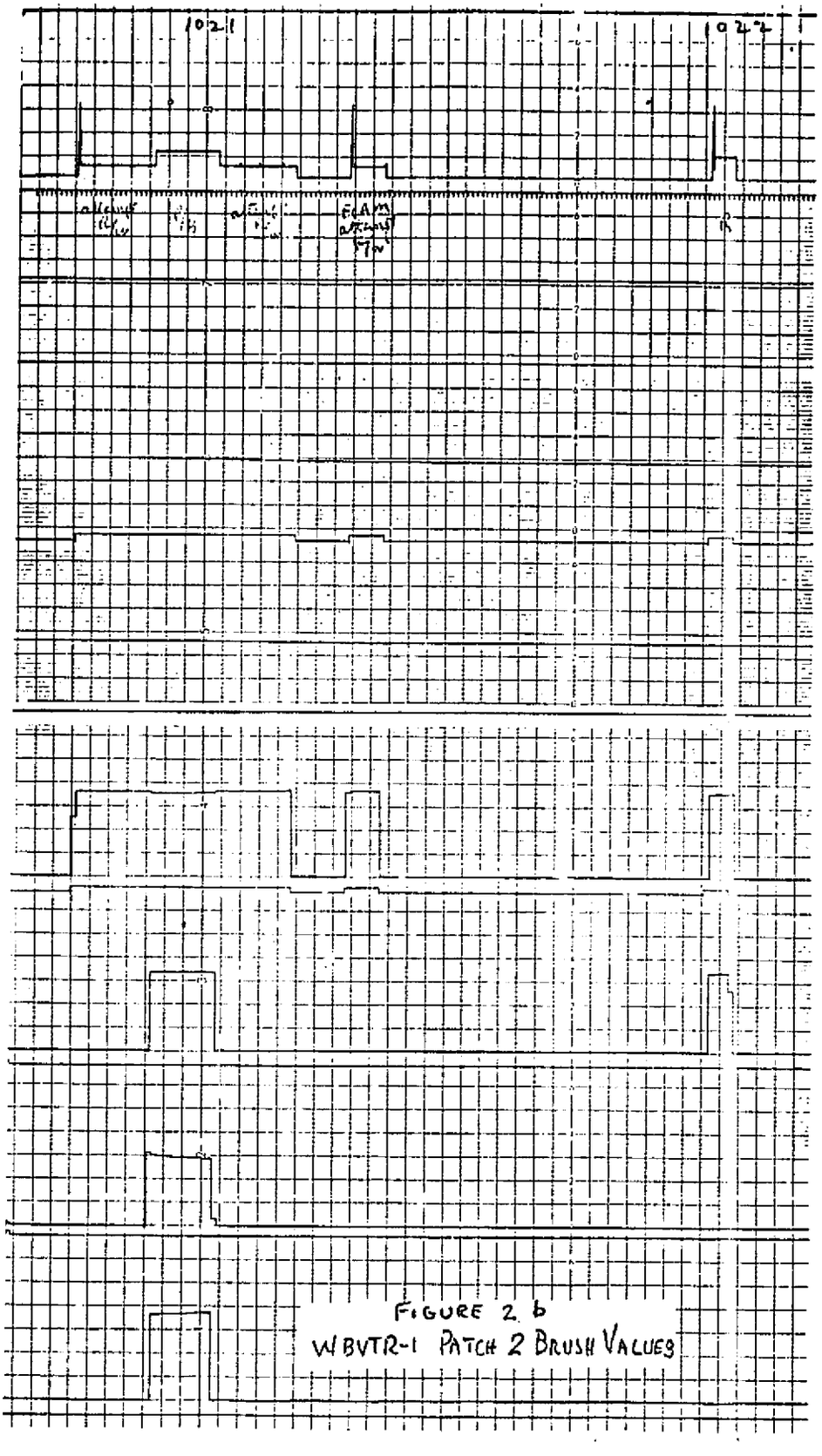


FIGURE 2.b
WBVTR-1 PATCH 2 BRUSH VALUES

TABLE 2

TELEMETRY VALUES OF BRUSH CHARTS

FIGURES 1 AND 2

FIGURE 1

FUNCTION	DESCRIPTION	UNIT	VALUE			
			S/B	R/W	REC	P/B
13031	Rec. Input Current	Amp	1.78	2.30	3.65	3.79
13030	Headwheel Current	Amp	0.45	0.44	0.50	0.49
13028	Capstan Current	Amp	0.0	0.014	0.28	0.28
13029	Playback Voltage	VPP	0.0	0.0	0.0	0.34
13034	+5.6 Volts	VDC	5.73	5.73	5.45	5.25

FIGURE 2

FUNCTION	DESCRIPTION	UNIT	S/B	R/W	REC	P/B
13032	Limiter Voltage	VPP	0.0	0.0	0.0	1.50
13033	Servo Volts	%	0.0	0.0	0.0	50.28
13026	Capstan Motor Speed	%	0.0	-	90.9	90.9
13027	Headwheel Mot. Speed	%	95.7	96.6	95.6	95.6
13023	Transport Unit Temp.	DGC	16.7	16.7	16.7	16.7
13024	Electric Unit Temp.	DGC	13.1	13.1	13.1	13.1
13022	Transport Unit Press.	PSI	16.9	16.9	16.9	16.9

TABLE 3

COMMAND HISTORY
LANDSAT-1 ORBIT 8646

TIME	CMD	DESCRIPTION
18:32:24	507	LAP 1
	426	WBR REC 1
18:33:27	505	STBY
18:35:08	426	WBR REC 1
18:35:11	505	STBY
18:35:21	426	WBR REC 1
:24	505	STBY
18:35:35	426	WBR REC 1
:38	505	STBY
18:36:14	507	LAP 1
:51	426	WBR REC 1
:57	505	STBY
18:37:10	426	WBR REC 1
:13	505	STBY
18:37:36	507	LAP 1
:44	426	WBR REC 1
:47	505	STBY
18:38:11	426	WBR REC 1
:14	505	STBY
18:38:24	426	WBR REC 1
:27	505	STBY
18:38:45	507	LAP 1
18:39:24	632	WBR OFF

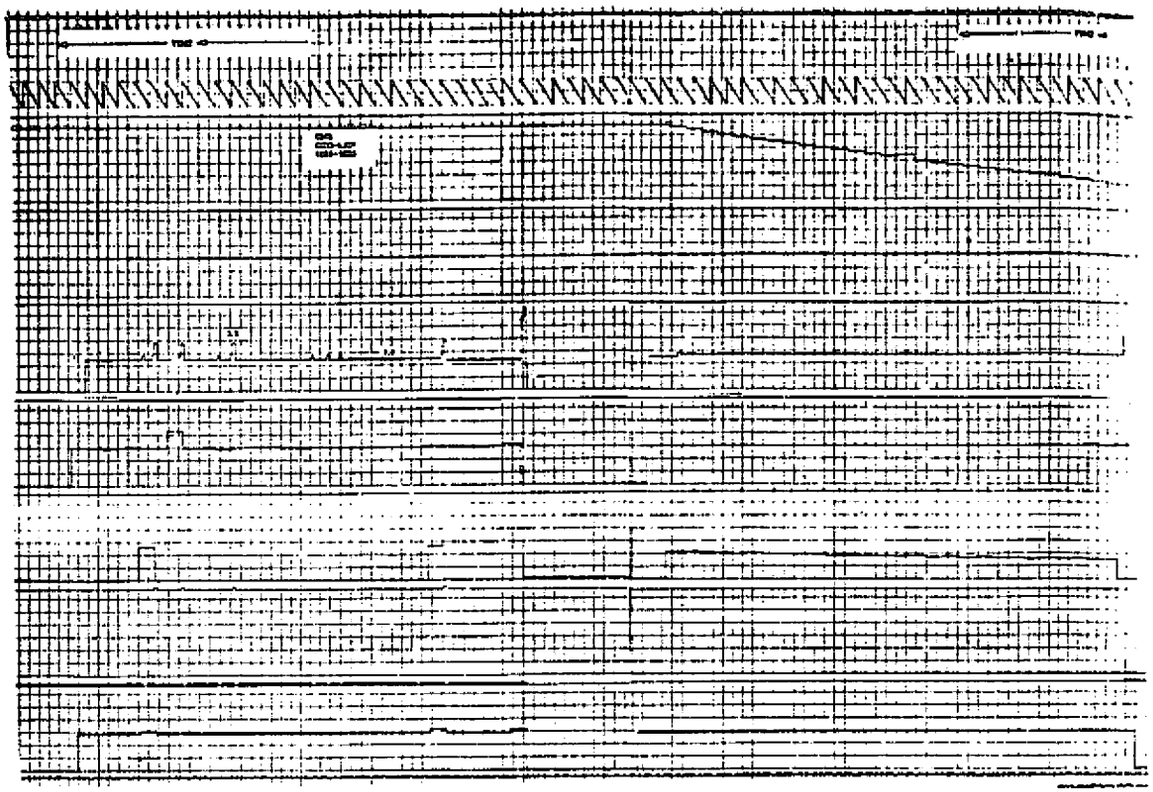
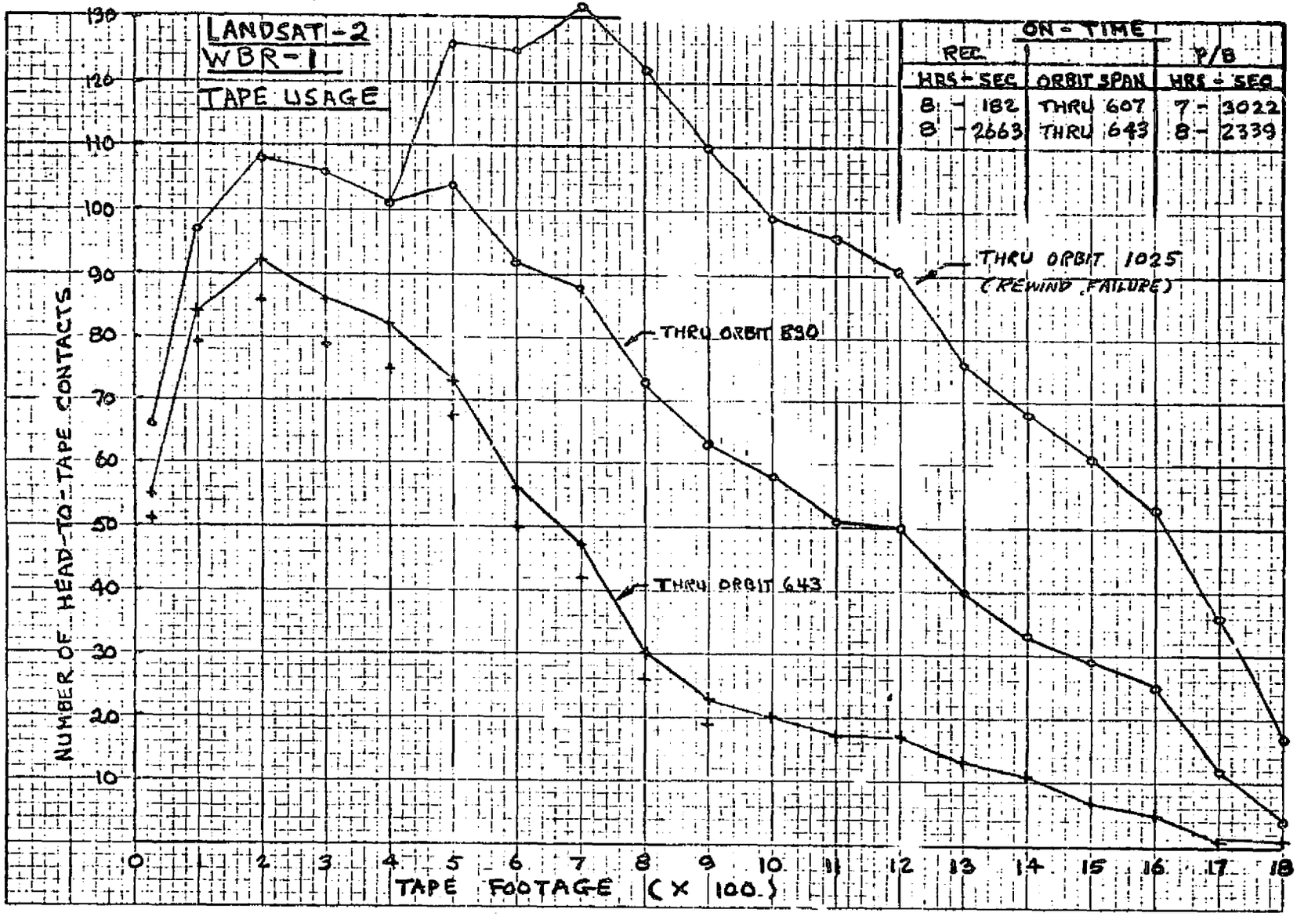


FIGURE 3
WBVTR-1 PATCH 1
LANDSAT 1 ORBIT 8646

FIGURE 4
TAPE USAGE BY FOOTAGE



APPENDIX D

RBV FLIGHT IMAGERY

Representative imagery from the RBV is shown in the following figures. Spectral bands are given in Table D-1.

Table D-1. RBV Imagery

Figure	Band	Wave Length (Micrometers)
D-1	1	0.475 - 0.575 Blue Green
D-2	2	0.585 - 0.680 Yellow-Red
D-3	3	0.698 - 0.830 Red-IR

All photographs show the same ground scene, 185 x 185 square kilometers in area. The scene covers a segment of the California Coast from Oxnard (right center) to Santa Maria (upper left, obscured by clouds). The suburbs of Bakersfield are visible in the upper right, with the San Rafael Mountains extending from Santa Maria to south of Bakersfield. The Santa Maria River can be seen coursing through the San Rafaels near the top center of the picture. Snow cover is seen over a considerable area of the mountains. Various familiar landmarks such as Vanderberg AFB, Cachuma Reservoir, and the city of Santa Barbara are located in Figure D-2. The Santa Barbara Islands, while partially obscured by clouds, are easily visible and identifiable. Primary traffic arteries are generally visible, and many secondary roads can be seen.

The difference in response of the three spectral bands can be observed by comparison of cloud and haze areas, and by differences in the relative contrast and grey levels of topographical features.

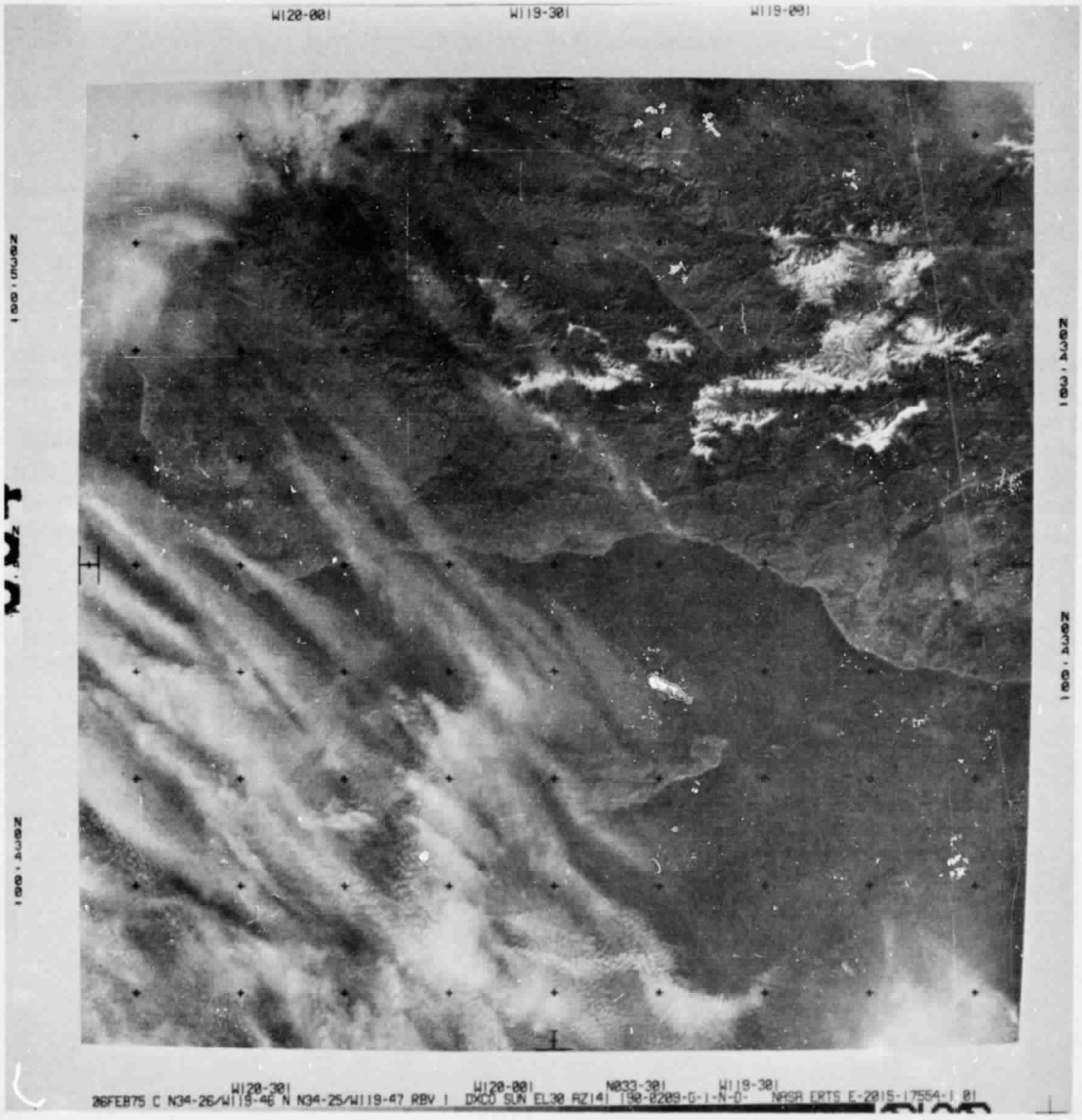


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Figure D-1. LANDSAT-2 RBV, Band 1

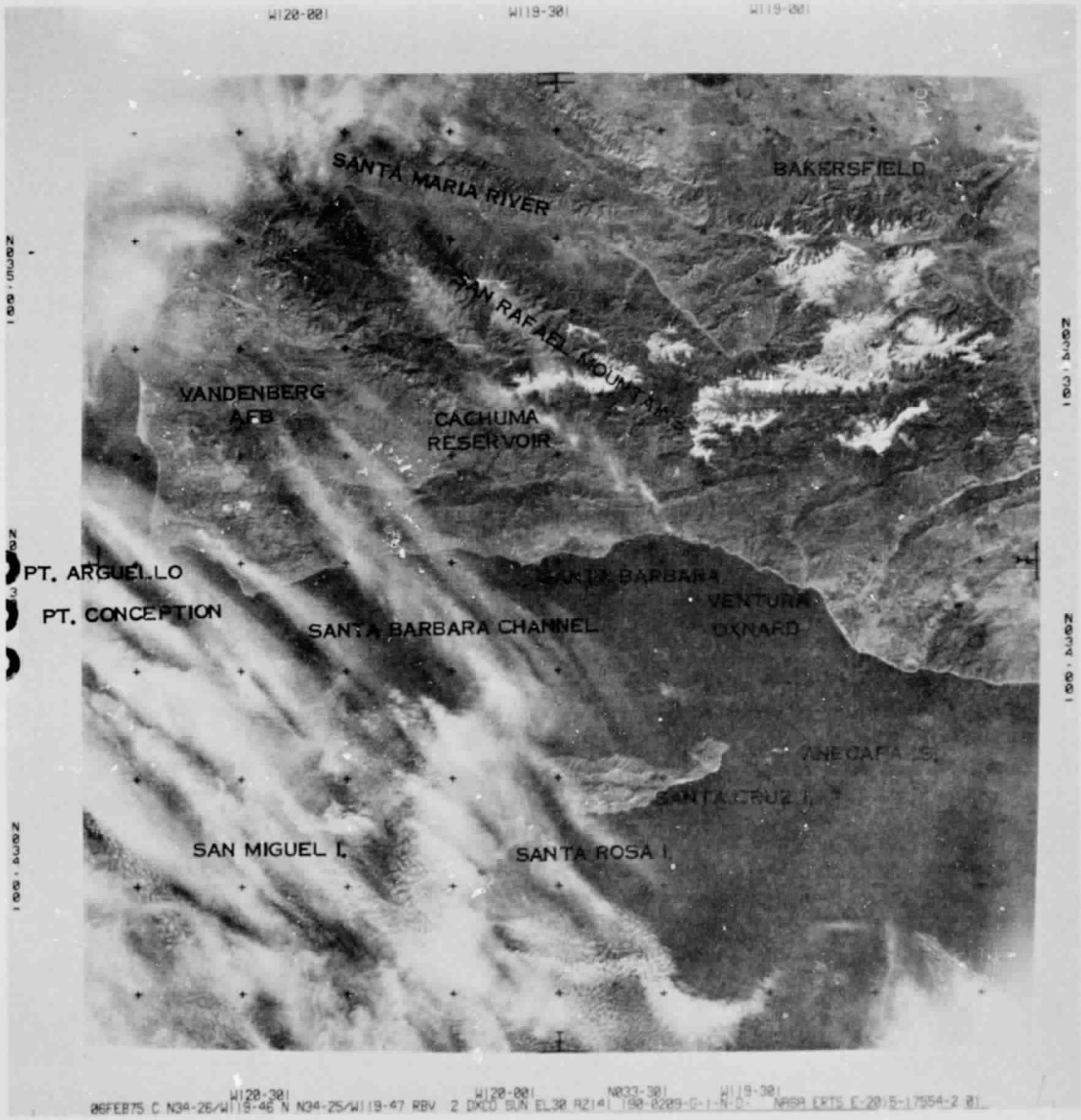

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Figure D-2. LANDSAT-2 RBV, Band 2

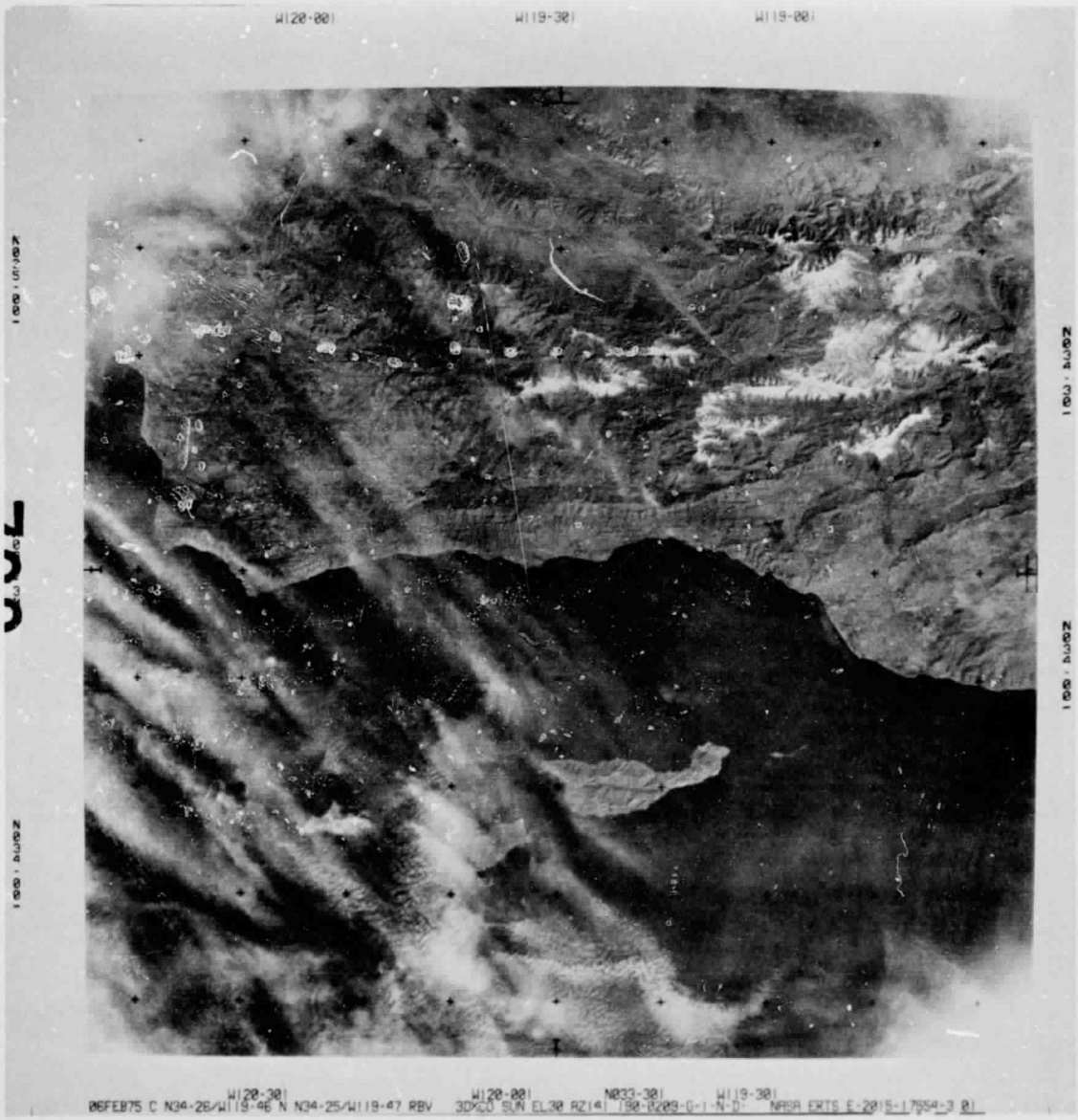

Figure D-3. LANDSAT-2 RBS, Band 3